MRT™
MOBILE RADIO TECHNOLOGY®

Technical information for paging, trunking and private wireless networks.

AUGUST 1998

Public safety site development
Reinventing trunking antennas
Microwave path design
APCO show guide

A PRIMEDIA Intertec Publication

Testing Radios Without Knowing The Frequency Or Tones Can Be Tricky

The One And Only Xplorer

1 The **Xplorer's** high speed sweep doesn't miss a thing. **Instantly demodulate** any RF carrier from **30MHz - 2GHz**. Quickly determine audio quality on any analog radio and monitor that frequency.

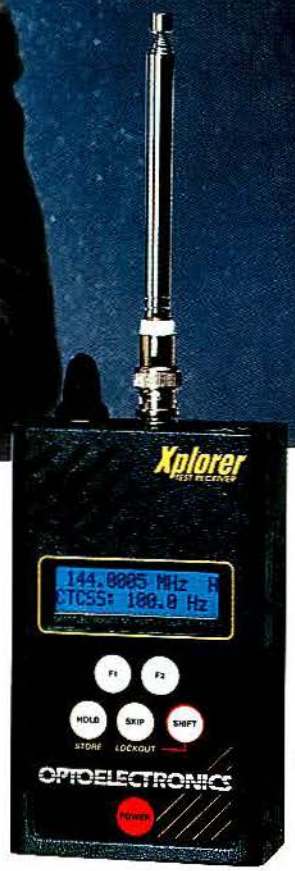
2 Quickly determines the frequency of a radio and displays that frequency on its **two line LCD display** Ideal for **quick radio checks**, automatically determining a radio's frequency **with out receiver setup time**

3 **Built-in decoder** instantly determines any **CTCSS, DCS, DTMF, or LTR** present for that frequency.

CTCSS Decode

DCS Decode

DTMF Decode



Patent No. 5,471,402

The Xplorer Features:

- 500 memories with time and date
- 1000 frequency lockouts
- Built-in PC interface
- Displays: frequency, CTCSS, DCS, LTR DTMF, Deviation and Signal Strength
- Auto / manual hold and skip
- Sweeps 30MHz - 2GHz in < 1 second
- 10 Lock in / Lockout frequency ranges

Copyright© 1998, Optoelectronics, Inc.

FACTORY DIRECT ORDER LINE: 800•327•5912

OPTOELECTRONICS®

5821 NE 14th Avenue • Ft. Lauderdale • FL • 33334
Telephone • 954•771•2050 Fax • 954•771•2052 Email: sales@optoelectronics.com

Specifications are subject to change without notice or obligation. Visa, MasterCard, C.O.D.

Circle (1) on Fast Fact Card www.optoelectronics.com MADE IN U.S.A

Download recorded frequencies to a PC with supplied PC cable.

What Allows Our Mobile Radio To Rise Above the Competition?

9800 Intruder Mobile

The Features.

Standard Features

- Front Firing Speaker
- 25/12.5 kHz Narrowband Operation
- 6.25 kHz Frequency Stepping
- LCD Alpha-Numeric Display
- Five Programmable Function Keys
- Two-Levels of Priority Scanning
- Eight Character Alpha Tags
- LTR® Compatible

LTR-Net™ Features

- Unique Radio ID
- Electronic Serial Number Identification
- Direct Radio-to-Radio Calls*
- Direct Inward-Dialed Phone Calls*
- Backward Compatible with Existing LTR Systems
- Cross-Band Calling Between Subscribers on UHF, 800 and 900 MHz channels
- Over-the-Air Management
- Roaming with Auto-Registration

* DTMF microphone required.

Voice Privacy Features

- Plug-In Scrambling
- High and Medium Security Options
- Hop Rates Up to 1000 Times a Second
- Automatic Reception of Secure and Non-Secure Signals
- Over-the-Air Programming With Radio Disable
- Compatible With Transcrypt CVP® Scrambling (SC20-410/430/460)
- Front Panel Clear/Code Activation
- Visual Clear/Code Mode Indication on LCD Display

EFJohnson®
A Product of TRANSCRYPT®

4800 NW 1st Street • Lincoln, NE 68521 U.S.A.
800-765-5365 • 402-474-4800 • Fax 402-474-4858
www.transcrypt.com

Transcrypt, EFJohnson, LTR and CVP are registered trademarks of Transcrypt International, Inc. LTR-Net™ is a trademark of Transcrypt International, Inc. ©1998 Transcrypt International, Inc

Circle (4) on Fast Fact Card

MRT™
MOBILE RADIO TECHNOLOGY®

Technical information for paging, trunking and private wireless networks.

contents

August 1998

On the cover: Construction on the Nevada Highway Patrol's new Round Mountain site. *Site photos by Will Galloway, Telewave; cover design by Scott Dolash, associate art director.* See story on page 14.

Photos by Will Galloway

features

14 A golden opportunity at Round Mountain
William Seethaler
A cooperative effort between public safety and private industrial radio users leads to development of a reliable radio communications site.

22 Fred M. Link: 'Goodwill Ambassador'
Don Bishop
As a mobile radio consultant, Fred Link became known to several generations.

26 Microwave path design: The basics
Jeff Ashley
Part 4—This series of four articles is a primer on some of the propagation-related basics of microwave path design.

34 Reinventing antennas
Don Simon and Jack Daniel
An effort to design a wideband antenna for trunking leads to an interesting new tool for multiple applications.

40 Time is tissue
MRT Staff
While the wireless voice and data technologies supporting EMS improve, research assesses use of wireless networks to trigger response at the moment of collision.

42 In pursit of interoperability
D.A. Keckler
Data gathered by the Justice Department provide a snapshot of where law enforcement agencies are now with communications interoperability—and where they think they're going.

50 APCO Show Guide

53 Y2K: Back to the future, or forward into the past?
Emily Reid
The millenium is near—prepare for new wireless opportunities once you and your vendors have debugged your wireless systems.

departments

4 Editorial
'...And now for something completely different.'

6 Calender

8 Editorial index
Editorial forum

10 In the public interest
Robert H. Schwaninger, Jr.
Paved with good intentions.

56 Technically speaking
Harold Kinley, C.E.T.
Continuing EMC issues.

59 News
Transcrypt International takes steps to overcome controversy about financial statements.

67 Product focus
Site security.

69 Products
Pyramid Communications is the Reader's Choice.

78 Media

79 People

80 Classified

96 Ad index

Mobile Radio Technology (ISSN 0745-7626) is published monthly by PRIMEDIA Intertec, 9800 Metcalf Ave., Overland Park, KS 66212-2215, and is mailed for free to qualified subscribers within the United States and Canada. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 0956309.
POSTMASTER: Send address changes to Mobile Radio Technology, P.O. Box 12960, Overland Park, KS 66282-2960.
SUBSCRIPTIONS: Non-qualified subscribers may subscribe at the following rates: United States and Canada: one-year: $35. Qualified and non-qualified persons in all other countries: one-year: $45 (surface mail); $105 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS, 66282-2937.

3 Great Products
for Public Safety
Applications

TOWER-MOUNTED PREAMPLIFIER

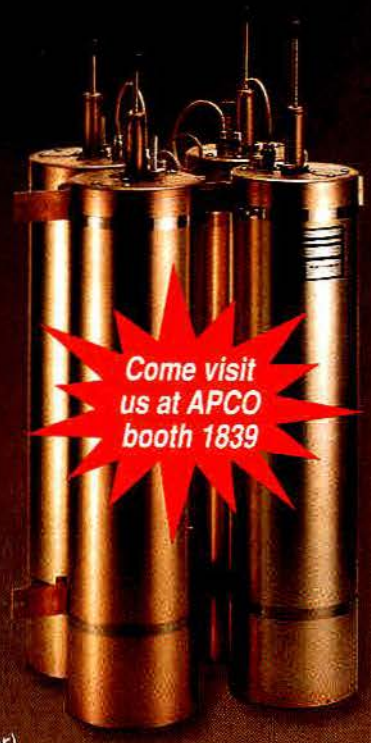
The new 423-Series brings economy with uncompromised performance to TX RX Systems' family of dependable tower-mounted preamplifiers. Model 423-86A-01-03 is designed specifically for use with Public Safety frequencies in the NPSPAC band.

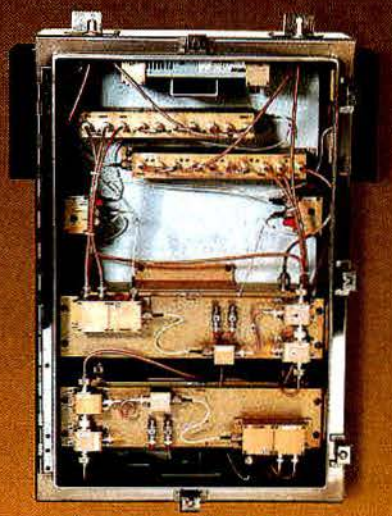
Model 423-86A-01-03
Pass Bandwidth: 821-824 MHz
Isolation @ 825 MHz: 35 dB
Gain: 14-15 dB
System Noise Figure: 3.0 dB
3rd O.I.P: +40 dBm
Weight: 22 lbs.

DUPLEXER

Vari-Notch®, the trademark for TX RX Systems' pseudo bandpass circuit design, offers the best cost-to-performance ratio in its class. Model 28-37-02A has been around for nearly 20 years. Its sound design, rugged construction, and long-term dependability make it an excellent choice for Public Safety applications.

Model 28-37-02A
Frequency Range: 144-174 MHz
Min. Freq Separation: 500 kHz
Insertion Loss: 1.5 dB
Isolation: 85 dB
Max. Power: 400 Watts





REPEATER AMPLIFIER (aka Signal Booster)

These amplifiers are used to extend radio coverage into areas such as convention centers, prisons, shopping centers, subways, and airports. Models are available with various gains, pass bandwidths, enclosures, supervisory and backup features. Model 61-89A-06-OLC-G2 is a popular choice for use in the NPSPAC BAND.

Model 61-89A-06-OLC-G2
Pass Bands: 821-824 & 866-869 MHz
Gain: +83 dB (typical)
3rd O.I.P: +44 dBm (typical)
Output Level Control: 35-40 dB
Enclosure Type: Stainless Steel NEMA 4X

FCC ID EZZ5PI901211

8625 Industrial Parkway
Angola, NY 14006
Ph: 716-549-4700
FAX: 716-549-4772
Email: sales@txrx.com

TX RX SYSTEMS INC.®

DUPLEXERS • CAVITY FILTERS • MULTICOUPLER SYSTEMS • SIGNAL BOOSTER SYSTEMS • RF SYSTEM PRODUCTS

A member of Bird Technologies Group

Circle (5) on Fast Fact Card

'...And now for something completely different'

Normally in this column you don't read about changes in the way our magazine is presented. Let the changes speak for themselves, I say.

But the redesign in this issue reflects the work of so many people that it is appropriate to recognize their efforts.

Most of the creative work was done by Associate Art Director Scott Dolash, working with Corporate Creative Director Doug Coonrod, and with help from Associate Editor Nikki Chandler and Features Editor David Keckler. The concept of a complete redesign was first proposed by previous Art Director Kim Wicker.

Originally, I asked for a redesigned table of contents to better accommodate the issue we distribute each year at International Wireless Communications Expo. One thing led to another, and a plan began to emerge for a comprehensive redesign—thus, the catch phrase, "But all I wanted was a new table of contents!" every time the redesign moved another step forward.

Some design elements that we've left behind had been used since the beginning, when the first issue was designed in the fall of 1982 by Pieper International, a typesetting company in Littleton, CO. The oxford rules, for example, those parallel wide and narrow lines at the top and bottom of each editorial page, are history. Goodbye, oxford rules. And welcome to a new table of contents page, not to mention the rest of these pages—thanks to the Dolash touch.

I appreciate all the effort, gang, but all I really wanted was a new table of contents!

Don

* * *

Technically speaking

We've been blessed to have monthly editorial contributions since Janaury 1993 from one Harold Kinley, C.E.T., from Spartanburg, SC. At the end of this year, Harold will mark six years as our most prolific columnist, and at that time, he's going to cut back on that assignment we've come to appreciate so much.

Each year, as Harold would talk about whether to continue writing, he would say, "Well, I still have one more kid to get through college," referring to the big stack of money we sent him each month. I guess it wasn't that big of a stack. But Harold enjoys writing, and with his experience as a technician and his ability to communicate, he is a natural for the column. Plus, he self-published a book about test instrumentation, and the column helps to spread the word.

At the end of this year, Harold will still have a son in college. His daughter graduated a year or two ago. I asked him, "Don't you think your daughter might want to go to graduate school?"

Harold has written some feature articles, too. That was him, driving the fire-suppression tractor pictured on the cover of the May 1993 issue. That issue included a feature explaining how to make a mobile rooftop antenna modification to prevent breakage from low-hanging objects.

George Dennis, editor of *Communications* magazine in 1993, said at the time, "The only thing we don't like about Harold is that you found him first!" (George is now director of competitor intelligence at Bellcore, Piscataway, NJ.)

Nice of George to give us credit, but actually, Harold came to *us* with the idea for the column. We had previously sought "technical tips" from dealers and technicians, but without much success. I once talked about Harold's column with a dealer, about how we previously couldn't find contributors at commercial service shops, and he offered this opinion: "Harold works for the state government," he said. "He doesn't have any competitors. I wouldn't want to reveal any technical methods that might give my competitors any help." Maybe that explains part of it, but I also happen to think that Harold is one-of-a-kind.

So, what now for "Technically Speaking"? With bimonthly contributions from Harold, we'll keep it going. I'd be interested in hearing from anyone who might want to write the column for the intervening months. Maybe the space will be taken by one person. Maybe the assignment will be rotated among a group of contributors. It can be difficult, sometimes, keeping to a monthly schedule, Harold says. But not impossible, as his track record indicates.

Let me know, won't you?

Tel. 913-967-1741; fax 913-967-7250; email *mrt@intertec.com.*

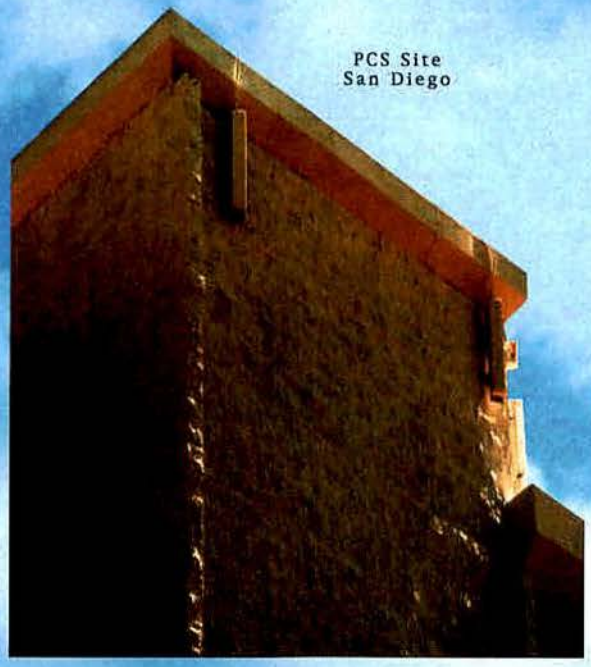
Don Bishop

A secure avenue into wireless utopia ...

Ponder for a minute ...

Information superhighways, on-ramps, speed bumps. Webs of destruction and deceit. Who has time for that?

Remember what got you here. No gimmicks, no monkey business; just solid RF design strategies coupled with selecting the best infrastructure on the market.



PCS Site
San Diego

At DAPA we offer a most comprehensive product line of site antennas, keeping in line with RF planning, aesthetics and zoning restrictions. We concentrate on a proven metal strip-line feed technology, unlike any other. It is proven to produce continuous peak performance, repeatability and peace of mind.

Not to mention our approved vendor status in cellular and PCS networks around the globe, including the first operational PCS system in the United States.

Oh yeah, and don't forget to tangle with us on the web, **http:\\www.dapacom.com**, where you can get the latest in product developments, antenna data, patterns, and spec sheets.

Ponder no longer.

DAPA®

BEYOND YOUR WIRELESS DREAMS®

DAPA Communications, Inc. • Allegany, New York 14706 USA
Int'l Tel +1 716 373 7228 • Int'l Fax +1 716 373 5758 • http:\\www.dapacom.com

Circle (16) on Fast Fact Card

'DAPA' and 'Beyond Your Wireless Dreams' are registered trademarks of DAPA Communications, Inc.

© 1997

calendar

August

9–13—International Association of Public-Safety Communications Officials (APCO) National Conference, Albuquerque, NM. Convention Center, Albuquerque. Contact: 904-322-2500.

12—Radio Club of America breakfast meeting, Doubletree Hotel, Albuquerque, NM. Contact: Tracy Keller, 972-580-1911.

September

23–25—Personal Communications Showcase, sponsored by the Personal Communications Industry Association, Orange County Convention Center, Orlando, FL. Contact: 703-739-0300.

23–25—PCS Latin America, sponsored by the Personal Communications Industry Association, Orlando, FL. Contact: Cathy Graham, 703-739-0300, ext. 3706.

October

12–14—Wireless I.T. 98, sponsored by the Cellular Telecommunications Industry Association, Bally's Las Vegas, Las Vegas. Contact: 202-785-2842.

14–16—TelecomLatina, co-sponsored by *Mobile Radio Technology*, Miami Beach Convention Center, Miami. Contact: 1-800-288-8606.

19–21—RF Design Conference & Expo, sponsored by *RF Design Magazine*, San Jose Convention Center, San Jose, CA. Contact: 1-800-288-8606.

28-31—Industrial Telecommunications and USMSS Joint Annual Conference, Grand Hyatt Hotel, Washington, DC. Contact: 703-528-5115.

November

4-5—ENTELEC and UTC Joint Seminar on Emerging Wireless Communications, Adams Mark Hotel, Houston. Contact: 202-872-0030; Web *www.utc.org*.

MRT
MOBILE RADIO TECHNOLOGY

REGULATORY CONSULTANT
Robert H. Schwaninger Jr., *Brown and Schwaninger, Washington, DC*

EDITORIAL ADVISORY BOARD
John Abbey, *The Abbey Group*
Gene A. Buzzi, *Omnicom Telecommunications Engineering*
Jack Daniel, *The Jack Daniel Company*
Gary David Gray, P.E., *Orange County Communications*
Frederick G. Griffin, P.E., *Frederick G. Griffin P.C.*
Jim Hendershot, *Radio Design Group*
Mary Kjorvestad, *Nextel Communications*
Samuel J. Klein, *Cellular Design*
S.R. McConoughey, P.E., *Mobile Communications Consulting*
Art McDole, *Salinas, CA*
Tony Sabino, *Regional Communications*
Herb Sachs, *Herb Sachs Consulting*
Robert C. Shapiro, P.E., *Strategic Telecommunications*
Leon Spencer, *Exxon Computing Services Company*
Gregory M. Stone, Ph.D., *Quantum Radionics*
Raymond C. Trott, P.E., *Trott Communications Group*
William A. Wickline, P.E., *Mentor, OH*

EDITORIAL
Don Bishop, *Editorial Director*
David Keckler, *Features Editor*
Nikki Chandler, *Associate Editor*
Emily Reid, *Editorial Assistant*
Erica Thesing, *Editorial Intern*
Harold Kinley, C.E.T., *Contributing Editor*

DESIGN
Scott Dolash, *Associate Art Director*

BUSINESS
Cameron Bishop, *President, Communications & Entertainment Division*
Mercy Contreras, *Group Publisher*
Scott Hanna, *Advertising Production Coordinator*
Nancy Hupp, *Director, Corporate Advertising Services*
Patti Lee, *Classified Advertising Coordinator*
Tom Cook, *Group Senior Managing Editor*
Doug Coonrod, *Corporate Art Director*
Stephanie Hanaway, *Director of Marketing and Communications, Intertec Trade Shows and Conferences Division*

PRIMEDIA Intertec
Raymond E. Maloney, *President and CEO*
Nick Cavnar, *Vice President of Circulation*
Barbara Kummer, *Circulation Director*
Julie Neely, *Circulation Manager*
Customer Service, *800-441-0294 or 913-341-0294*

PRIMEDIA Inc.
William F. Reilly, *Chairman and CEO*
Charles McCurdy, *President*
Beverly C. Chell, *Vice Chairman*

CORRESPONDENCE: Editorial correspondence should be addressed to P.O. Box 12901, Overland Park, KS 66282-2901. tel. 913-341-1300; fax: 913-967-7250; *mrt@intertec.com*

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional and cellular RCC and WCC, mobile radio equipment manufacturers, manufacturers' reps, distributors, engineering/consulting firms, national/state/local government, military agencies, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

PHOTOCOPY RIGHTS: Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by PRIMEDIA Intertec, provided that the base fee of US $2.25 per copy, plus US $00.00 per page is paid directly to Copyright Clearance Center, 222 Rosewood Dr., Danvers, MA 01923, USA. The fee code for users of the Transaction Reporting Service is 0745-7626/1998 $2.25 + $00.00. For those organizations that have been granted a photocopying license by CCC, a separate system of payment has been arranged. Prior to photocopying items for educational use, please contact CCC at 508-750-8400. Organizations or individuals with large quantity photocopy or reprint requirements should contact Cherie Wood, 913-967-7212.

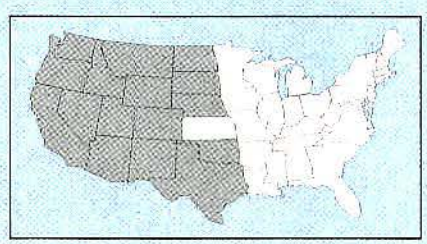
BACK ISSUES: Copies of most issues printed within the past two years are available for $10 per issue; older issues are not. Call customer service at 800-441-0294.

ARTICLE PHOTOCOPIES: Photocopies of individual articles printed since January 1987 may be ordered from UMI at 800-248-0360.

This publication is available from UMI in one or more of the following formats: online, microform, document delivery, and electronically. Call toll free 800-521-0600, Ext. 3781, for more information.

ADVERTISING SALES OFFICES

OVERLAND PARK, KANSAS
Joyce Bollegar, 913-967-1840,
East Region (including Eastern Canada)
Fax: 913-967-1901
Dawn Rhoden, *Classifieds*,
913-967-1861, Fax: 913-967-1735
Lori Christie, *List Rental Services Representative*,
913-967-1875, Fax: 913-967-1897
9800 Metcalf Avenue
Overland Park, KS 66212-2215



SANTA ROSA, CALIFORNIA
Dennis Hegg, *West region (including Alaska, Hawaii and Western Canada)*
Phone: 707-541-3763
Fax: 707-541-3721
3428 Mendocino, Avenue
Santa Rosa, CA 95403

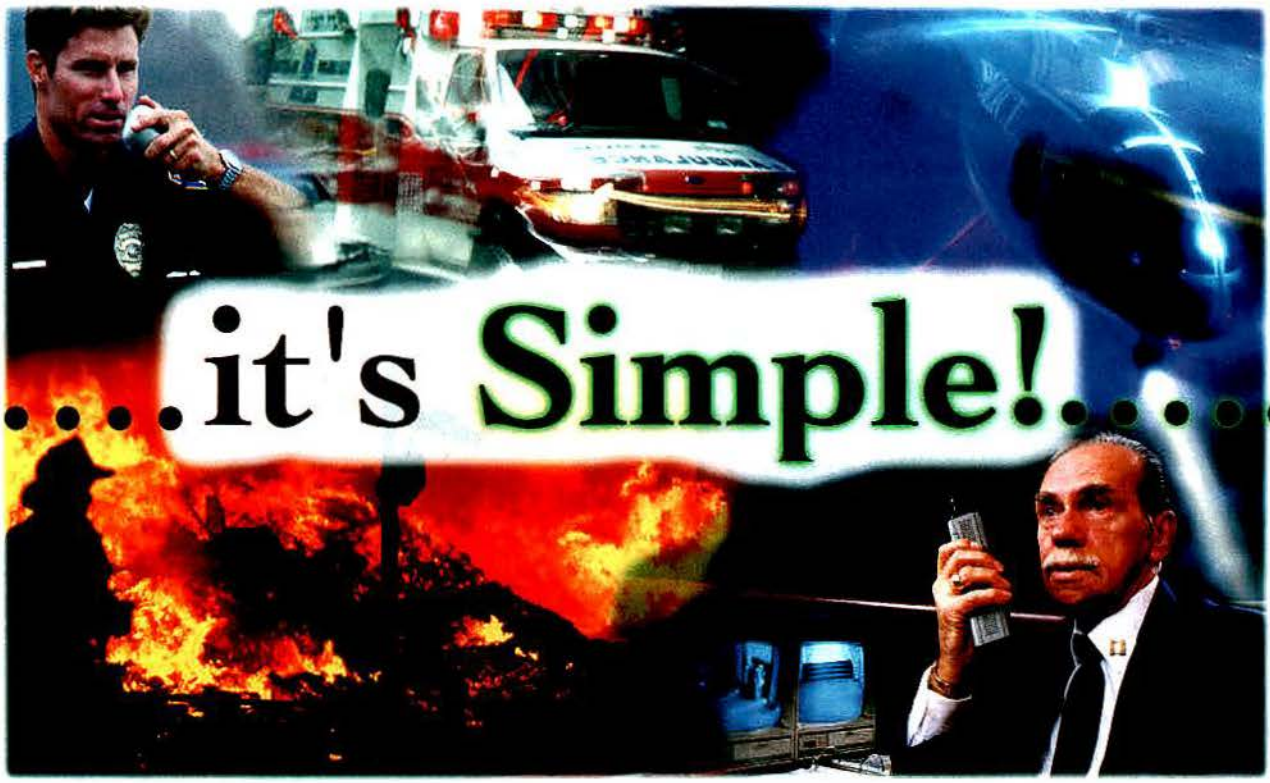
ENGLEWOOD, COLORADO
Mercy Contreras, *Group Publisher, 303-220-4245*
Phone: 303-793-0448
Fax: 303-793-0454
5660 Greenwood Plaza Blvd., Suite 350
Englewood, CO 80111

OXFORD, ENGLAND
Richard Woolley, *International*
Phone: +44 1295 278 407
Fax: +44 1295 278 408
P.O. Box 250
Banbury, Oxon, OX16 8YJ
United Kingdom

PRIMEDIA
Intertec

BPA ABC **Audited circulation.**

© 1998 by PRIMEDIA Intertec. All rights reserved.



Analyzing your battery, has never been easier!

AdvanceTec's *PULSE* Analyzer™ eliminates the guess work from your battery's daily life. ***It's Simple!*** Insert the battery and you'll know exactly how long your communication line will be connected. Because there's no time for surprises in the middle of a crucial moment, the life of your battery is something you need to know. And at our competitive prices, you can not afford not to know.

Digital display shows battery capacity.

Features of the AdvanceTec *PULSE* Analyzer™:

- Simple to operate. No Buttons to Press.
- Insert the battery in place and the unit will do the rest.
- Digital display will show the capacity of the battery.
- Available in 1 and 4 station configurations.
- Compatible with Ni-Cd and NiMH batteries.
- Slim line / compact in design
- Made in the U.S.A.

For Sales Information Call: 1-800-881-8211

ADVANCETEC INDUSTRIES INC

451 N.E. 189th St., Miami, FL 33179
Tel: (305) 651-3211 • Fax: (305) 651-3296
E-mail: sales@advancetec.com
www.advancetec.com
Circle (17) on Fast Fact Card

editorial index

The following companies are mentioned in this issue's features and news stories. Companies with New Products and Media listings for which Fast Fact numbers are provided are not included.

3COM 55
Advanced Charger Technology 79
Allen Telecom 66
American TriTech 40, 65
Antenna Specialists 66
Bell Laboratories 60
BellSouth Wireless Data 66
BellSouth 66
Cerulean Technology 40, 65, 79
Cleco 66
CMC Distributing 66
CommServe Marketing 65
Communications Marketing 66
Coopers and Lybrand 59
CPI Communications 66
Dataradio 66
Decibel Products 66
Deutsche Bank Securities 55
E.F. Johnson 59
Eitan, McCoy and Calhoun 60
Electro-Comm West 66
Empower Geographics 79
Ericsson 54, 55, 65, 66
Flagship Marketing 66
Gabriel Electronics 65, 79
Geotek Communications 60
Glenayre 66
Hark Systems 66
Hewlett-Packard 54, 55
Hutton Communications 62
IBM 65
ICOM America 64
KPMG Peat Marwick 59
Leavitt Communications 66
Lucent Public Safety Systems 60
Lucent Technologies 55, 60
Midland USA 66
Midwest Traffic Products 62
Motorola 55, 66
National Dispatch Center 79
Newmar 79
Nortel 55
PageNet 66
PanaVise Products 66
PRIMEDIA Intertec 61
Pyramid Communications 79
Racom Products 40
RAM Mobile Data 66
Round Mountain Gold 16
S-C Rig Investments III 60
Siemens 55
Soros Group 60
Telewave 16
Transcrypt International 59, 66
Trimble Navigation 62
TriTech Software Systems 65
TX RX Systems 34
Uniden 66
Warner Group, The 63
World Wireless Communications 66
Zetron 40

editorial forum

Searching ...

When this issue of the revamped *MRT* arrives in your mailbox, most of our staff will be trying to avoid Bugs Bunny's notorious "left turn at Albuquerque"—that is, we'll be on our way to APCO 1998. On a recent manufacturer visit, I recounted the story of my first five minutes on the exhibit floor at last year's show in Charlotte, N.C. As I began loading our table with copies of the magazine, an officer darted forward and snatched one up. He informed me that when he joined his department several years ago, equipped with a extremely applicable degree in art history, they looked at him and said "You're the new communications officer." Budgets being what they are in small departments, it was on-the-job training.

"Most of what I've learned I got by reading *MRT*," he said.

Needless to say, my step was lighter for the rest of the morning. That is what technical magazines are all about for editors—producing something useful for the readers.

The Charlotte episode was also on my mind while preparing this month's feature on communications interoperability (page 42). My interview with Tom Tolman of NLECTC—RM included discussion of how tough it is to get adequate funding for training (let alone radio equipment) in the majority of local and state agencies.

That officer I met was lucky—he made it to APCO last year. But there are dozens like him who may never join us there. The burden is on the participants and the radio trade press to dispense what we learn to those who can really use it. APCO does this through chapter activity. We do it through technical articles.

This is the time of year when I map out the technical feature content of *MRT* for the coming year. (If you've wondered, that's part of what I do here.) We have no trouble getting article proposals from equipment manufacturers. An editor with an open calendar is like a female moth that releases all its pheromones in one mist. It attracts all the males for miles around, and every one of them is a public relations agent. We actually do welcome their attention, but what we really need is to hear from you, the readers.

What do you need to know to make you a more effective communications manager, a more technically expert dealer, a more competitive service provider? If you're a technician, what do you need to know that's not covered in the manuals? Send your ideas to us by email at *mrt@intertec.com* or drop us a card. We'll listen and help you find answers.

Better still, if you *have* some of the answers to these questions, we may publish you. You don't have to be Arthur C. Clarke to write an article. Some of roughest articles to get ready for publication come from PhDs, and some of the easiest to shoot through to print come from straight-thinking, hands-on people who haven't written a paper since high school. (That's also part of what I do here—get your article ready to publish.)

What you have to say may be useful to the communications officer who won't make it to this year's show.

—D.A. Keckler, Features Editor

letters

Something bothering you?
Want to sound off about it?
Need help that other
readers might provide?
Or just want to comment?

Email us at ***mrt@intertec.com.***
Please include your name, job title,
company and a phone number.
We still accept "snail mail," too:

MRT
9800 Metcalf Ave.
Overland Park, KS 66212

Foresight.

Hindsight.

Site Master™ lets you see potential quality problems before your customers do.

Customers expect perfection. Better preventive maintenance is the way to deliver it. That's why there's Site Master.

Site Master makes sure small problems don't turn into big ones. It records antenna system signature characteristics and stores them for comparison over time. Site Master even works in the presence of live site interference. And thanks to Frequency Domain Reflectometry, potential problems can be pinpointed and repaired, saving time and money. That's what preventive maintenance is all about.

But seeing is believing. For information or to set up a demonstration, call 1-800-ANRITSU today.

Linking the World

Site Master

Anritsu

One world. One name. Anritsu.

©1997 Anritsu Company. Site Master is a trademark of Anritsu Company. Sales Offices: United States: 1 800 ANRITSU; Canada: (613)828-4090; Europe: 44(0)1582433200; Japan: 81(0)3446-1111; Asia Pacific: 65 282 2400; South America: 55(21)286 9141; http://www.global.anritsu.com

Circle (18) on Fast Fact Card

Paved with good intentions

By Robert H. Schwaninger, Jr.

The FCC and the Industrial Telecommunications Association (ITA) announced a new era of cooperation in April for the resolution of interference complaints, whereby ITA will stand as the first line of defense in resolving problems between private operators. The Memorandum of Understanding (MoU) released by the FCC claimed that the benefits will be a dramatic streamlining of the FCC's compliance and enforcement process. An intelligent person responding to the agency's description might easily ask, "What enforcement process?"

That harsh, albeit obvious, question aside, I congratulate ITA for its guts. Resolving interference complaints has always been problematic, particularly between cochannel users of shared spectrum. Yet, ITA has boldly stepped forward and volunteered to fill a vacuum that is so large, the sucking sound it creates can be heard at each of the FCC's monitoring stations. The FCC's enforcement record is so poor that an operator could solve an interference problem faster with a nail file applied slowly to a guy wire than with a complaint to a government official.

ITA's civic-minded action must, therefore, be viewed in the total context of the FCC's past record and present politics. If ITA is to be effective in its efforts, it must have a chance to succeed. But will it? If I have my doubts, my suspicions are not laid at ITA's feet, but before the throne of deregulation upon which rests the FCC.

To be successful, ITA must have the FCC's support. ITA does not have enforcement authority and cannot force operators to recognize its findings or abide by its recommendations. In this, ITA is akin to a neighborhood watch group, with bright orange vests, walkie-talkies and jawboning tactics, ready to alert the cops when it spots a truly dangerous situation. But if the cops don't show when called, the neighborhood watch group is pretty helpless. My experience shows that the FCC cops are permanently parked at the doughnut shop.

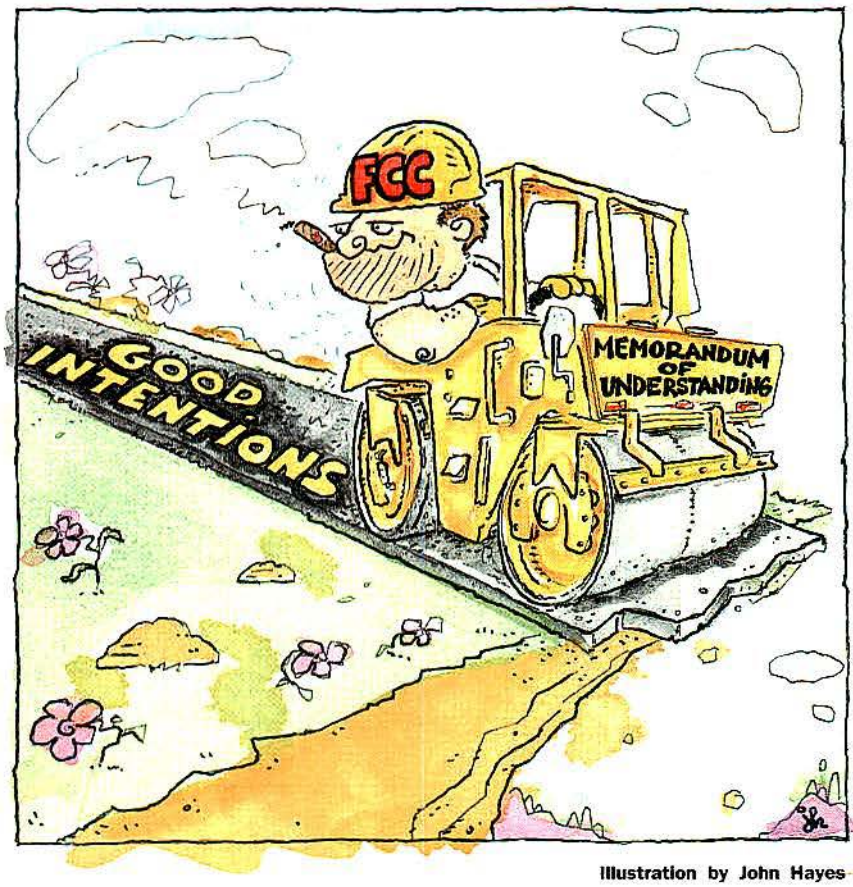


Illustration by John Hayes

No good deed...

An operator in Pennsylvania was suspected of having created intentional harmful interference to no less than three cochannel operators, four local police forces, two hospitals and anyone else that dared use his PCP channels. After delaying an investigation for months, the FCC field office monitored the frequencies and decided that the errant operator *might* be causing a problem. The FCC sent the operator an official inquiry, asking him if he was causing a problem. He said he wasn't. Case closed.

But the complaints continued, so the FCC set up a monitoring program, employing the shop of one of the complaining cochannel operators. Seventeen videotapes were produced to record the interfering signals as they appeared on a spectrum analyzer. Decoding and recording devices produced reams of evidence showing that single cap codes were receiving thousands of pages per month from the illegal system and that the information sent was duplicative.

An investigation by the Personal Communications Industry Association recommended that the interfering operator abandon the channel. The FCC sent an investigator to some of the interfering operator's sites to examine his transmission equipment. A meeting was called in Washington before the Field Operations Bureau (now the Compliance and Information Bureau). The FCC's investigation showed that the operator was not complying with the terms of his license and was improperly passing traffic between RCC and PCP facilities.

In an amazing act of spectrum management, the FCC issued a Notice of Apparent Liability, demanding a forfeiture of $16,000 from the bad actor. The bad operator promptly filed a request for a consent decree which, in effect, said that he might have done some inadvertent acts that may have caused interference. But accidents happen, and the agency should reduce the fine to zero, while proclaiming that it was all an unfortunate misunderstanding. That request is still pending after three years.

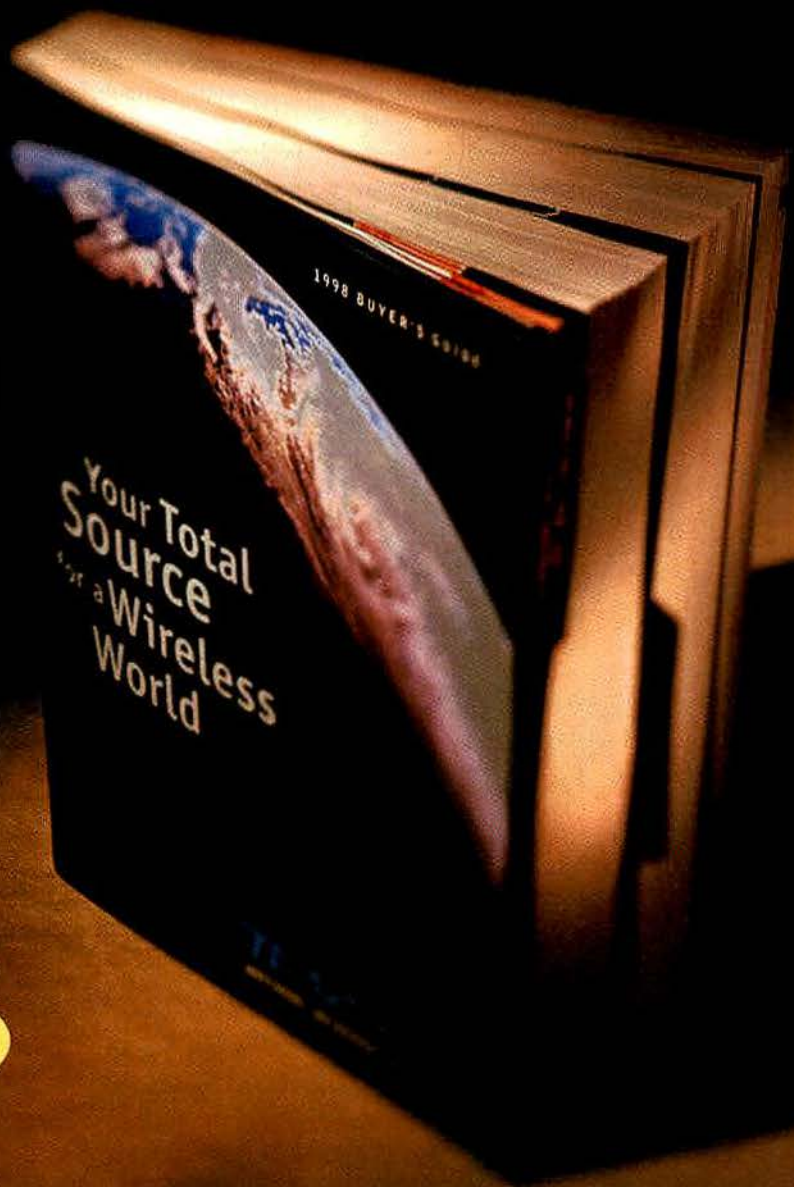
The above example is quite rare—the FCC actually *did* something. Oh sure, the interfering operator was able to delay any action for months, and never paid a fine, and the agency has not lifted a finger to enforce its NAL, but that's quibbling. Then there's "the *rest* of the story."

The *legitimate* operator whose business

Schwaninger, MRT's regulatory consultant, is a partner in the law firm of Brown and Schwaninger, Washington, DC. He is a member of the Radio Club of America.

All the information you need for a wireless world...

(4.7 lbs. of it, to be exact.)



TESSCO Magic® 3.0 Buyer's Guide software also available on CD-ROM!

an ISO 9002 registered company

Navigate your way through the wireless world with the one-of-a-kind book that's the most sought after tool in the industry. In it you'll find everything you need to build, run, maintain or use a wireless system. More than 17,000 products and 275 manufacturers in all, with guaranteed delivery anywhere and anytime.

Infrastructure Products • Mobile and Portable Accessories • Shop Supplies • Tools • Test Equipment

So, whether your business is cellular, PCS, paging, or two-way radio communications, look to the book. The TESSCO Buyer's Guide. It's free to qualified service organizations. Request yours today.

©1998 TESSCO Incorporated • Global Logistics Center • 11126 McCormick Road • Hunt Valley, Maryland USA 21031-1494
FAX 410-527-0005 *(USA, Canada, Mexico)* • FAX 410-229-1480 *(All Other Countries)*

TESSCO

800-472-7373
(USA, Canada, Mexico)

+1 410-229-1200
(All Other Countries)

www.tessco.com T12

Circle (19) on Fast Fact Card

suffered tremendously due to the bad operator's harmful interference sued the bad operator for business losses. After going up through the appellate courts, the injured operator was totally rebuffed by the courts' decisions because of the FCC's failure to resolve the consent decree request. The courts deemed it an open question subject to the agency's exclusive jurisdiction regarding radio transmissions. The injured operator requested an opinion from the FCC that it did not mind if he sued for damages in local court, but the FCC never responded to the operator's request.

The injured operator spent thousands on legal fees, personnel time, lost business and a host of other costs. The bad operator spent thousands on legal fees, but came away without a fine and free from civil liability. The FCC got to publish a decision that showed that it was tough on interfering operators. Oh yes, the hospitals got to buy new equipment to avoid future interference and the police forces switched carriers to use one of the systems operated by the bad operator because those systems were more interference-free. In essence, the cops paid for the bad actor's legal fees.

Politicians with a badge

ITA's noble enforcement gesture is laudable, but I fear it's a bit naive. The FCC simply does not wish to enforce its rules. It's messy and expensive, and it's political dynamite. What if the company that's being charged has political pull? What if the results of an enforcement study point up that a particular type of operation simply cannot peacefully coexist in the marketplace? Or what if an investigation shows just how inept the FCC is in this area? Will the agency take decisive action?

The FCC records are overflowing with untouched complaints and evidence of operators whose businesses failed due to agency inaction in interference, forgery, perjury, strike applications, abuse of process, slamming, jamming, pirating, cloning and every form of electronic-administrative destruction imaginable. When the problem gets too pervasive, the agency does little, if anything, about individual complaints. Instead, it merely rewrites the rules to accommodate the problem.

One recent example is the FCC's forbearance of its equipment authorization rules for personal computer manufacturers. The devices did not comply with the radiation rules when tested. So, the FCC stopped testing and allowed the manufacturers to "pinky swear" that their devices complied. Good enough.

Another example is the FCC's upping the number of telephone lines that have to be out of service before the local exchange carrier is deemed to have had a failure significant enough to be subject to reporting requirements. Get that reporting requirement number high enough and the agency can proudly claim that "There have been no reported failures."

ITA's efforts will be used by the FCC to prove to Congress that the agency is still in the spectrum management business ... that it *cares*. It will co-opt ITA's valiant efforts and claim ownership over the successes of the program, while leaving ITA to sort out the failures. The FCC-ITA enforcement program will result in a political partnership, the likes of which haven't been seen since McGovern backed Eagleton "1,000%."

The situation wouldn't be so tragic if the livelihoods of so many operators were not at stake. But I fear what ITA is doing, by volunteering for this unenviable task, is becoming an enabler, allowing the FCC to affect a stern mask of enforcement, while beneath the mask, it sports a bored grin. ■

Vega's Model C-6124

Get out of the heat with Vega's model C-6124, with its cool touch-screen and independent line selection. The C-6124 offers up to 24-line control, instant PTT, and loads of additional features.
Any line can he configured as a dedicated 2/4 wire radiocircuit, dial-up access or full duplex conventional PSTN telephone circuit, (simply plug in the appropriate module). Any combination of lines can be set-up in a crosspatch mode. C-6124 with it's future expandability will keep you out of the inferno.

VEGA
Signaling Products Group

9900 East Baldwin Place
El Monte, California 91731-2294

Telephone: (626) 442-0782
Toll-Free: 800-877-1771
Fax: (626) 444-1342 • FaxBack: (626) 444-2017 / 800-274-2017
email: vega_signal@earthlink.net
www. vega-signaling.com

Circle (20) on Fast Fact Card

...POWER ON WITH ASTRON
SWITCHING POWER SUPPLIES...

SPECIAL FEATURES:

•HIGH EFFICIENCY SWITCHING TECHNOLOGY SPECIFICALLY FILTERED FOR USE WITH COMMUNICATIONS EQUIPMENT, FOR ALL FREQUENCIES INCLUDING HF.

- •HEAVY DUTY DESIGN
- •LOW PROFILE
- •LIGHT WEIGHT PACKAGE
- •EMI FILTER
- •MEETS FCC CLASS B

PROTECTION FEATURES:

- •CURRENT LIMITING
- •OVERVOLTAGE PROTECTION
- •FUSE PROTECTION
- •OVER TEMPERATURE SHUTDOWN

SPECIFICATIONS:

INPUT VOLTAGE: 90-132 VAC 50/60 Hz OR 180-264 VAC 50/60 Hz SWITCH SELECTABLE

OUTPUT VOLTAGE: 13.8 VDC

MODEL	CONT. AMP	ICS	SIZE (inches)	WT.(lbs.)
SS-10	7	10	2.3 x 6 x 9	3.2
SS-12	10	12	2.3 x 6 x 9	3.4
SS-18	15	18	2.3 x 6 x 9	3.6
SS-25	20	25	2 7/8 x 7 x 9 3/8	4.2
SS-30	25	30	3 3/4 x 7 x 9 5/8	5
SS-25M*	20	25	2 7/8 x 7 x 9 3/8	4.2
SS-30M*	25	30	3 3/4 x 7 x 9 5/8	5

- *with separate volt and amp meters
- All SS power supplies are available in a RACK MOUNT VERSION (3.5 x 19 x 9 3/8)
- To order Rack Mount Version change SS to SRM (example: SRM-10)

ASTRON CORPORATION

9 Autry, Irvine, California 92618
949-458-7277 Fax 949-458-0826
www. astroncorp.com

Circle (6) on Fast Fact Card

A golden opportunity at Round Mountain

A cooperative effort between public safety and private industrial radio users leads to the development of a reliable radio communications site. A new philosophy of site selection for year-round radio coverage and creative antenna system design play key roles.

Closeup of final adjustment of transmit array

Photo by Will Galloway

By William Seethaler

Two common problems faced by site planners and system managers are the high cost and difficult access often associated with the most desirable locations for a wide-coverage, multi-agency communications site.

This was the case in Central Nevada, where the Nevada Highway Patrol (NHP), Nye County and several other users depended on Shoshone Peak (9,200 feet) for radio coverage in the Big Smoky Valley north of Tonapah. Police, fire, roads and public works systems were all located on the peak.

Flanked to the east and west by the 12,000-foot Toquima and Toiyabe mountain ranges, the Big Smoky Valley curves gently for about 100 miles. State Route 376 is the only highway through the middle of the valley, and it is the main link between Tonapah and Austin, on Highway 50, to the north.

Shoshone Peak had the advantage of an existing dirt access road, circumventing Bureau of Land Management regulations that prevent road building on most publicly owned peaks. Budget limitations prevented construction of facilities for commercial power, and a combination of solar panels and battery banks provided power to the various repeater systems and remote receivers.

Seethaler is marketing and sales manager for Telewave, Mountain View, CA. Part numbers mentioned in this article refer to Telewave products.

Antenna tower showing NHP electrician and heavy crane

Accessible in winter only by a slow, dangerous climb in a snow cat, the site is vulnerable to frequent damage from ice storms that regularly tear antennas off their mounts, leaving troopers and county personnel without radio coverage.

Making matters worse, the mountain micro-climate often produces thick fog, cutting off light to the solar panels. Although extra batteries and remote start generators were considered, it was not possible to sufficiently harden the site against winter storms, and three years ago the search for a replacement began.

Efforts by both agencies to relocate the site were slowed by the same budgetary limitations that brought about its creation. The costs of land acquisition, restrictions on road building and extension of commercial power made development of another high-elevation site nearly impossible. Early in 1997, Nye County and NHP came together in their search. Both agencies made extensive use of VHF highband channels, ensuring technical compatibility. They made a decision to emphasize year-round access and availability of commercial power rather than elevation.

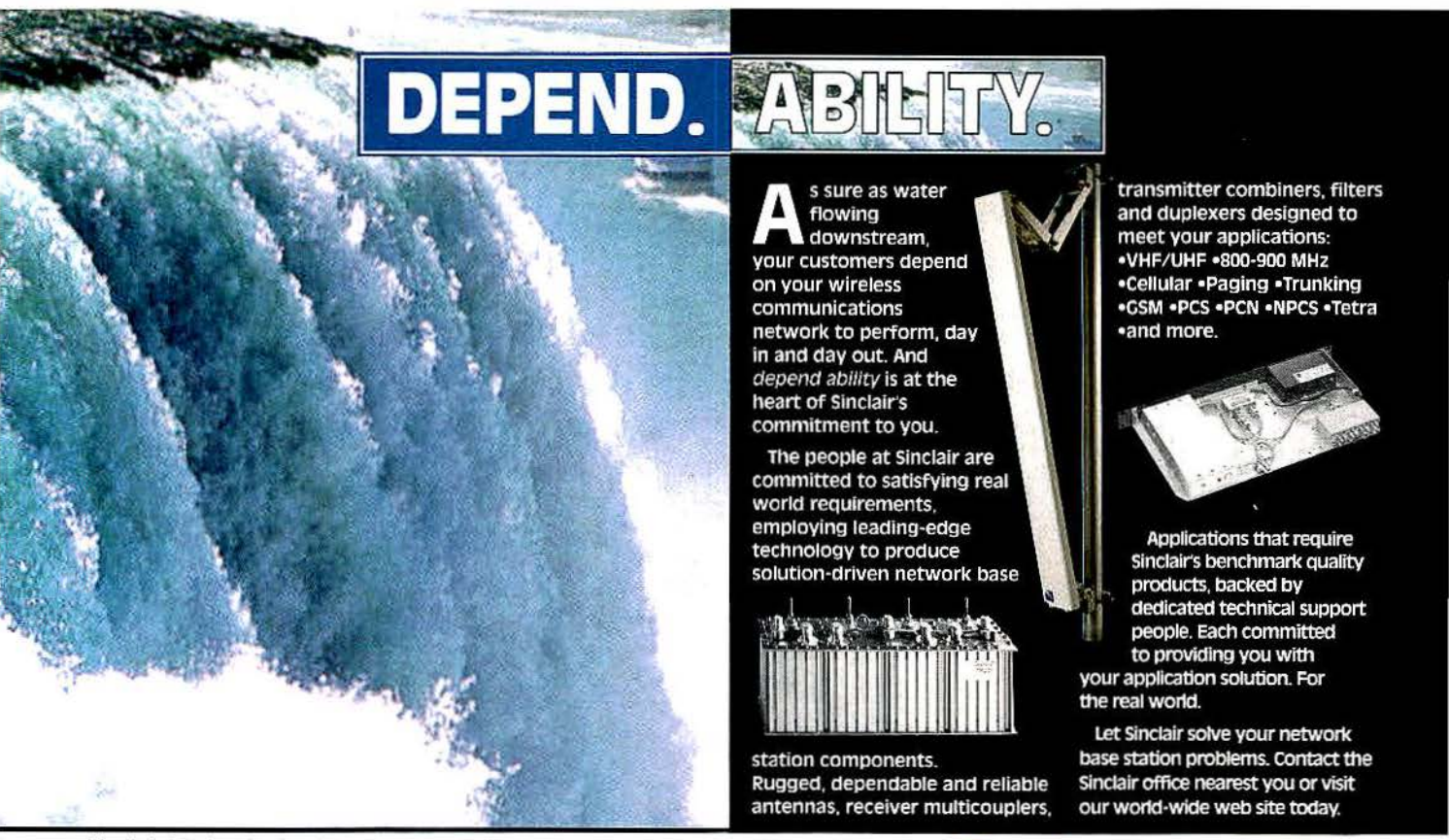
This would require a site below the annual snow line, but high enough to cover the 2,000-square-mile valley, with its two tall mountain ranges cutting off radio coverage from outside. During the previous year, Nye County Communications Manager Terry Payne had approached Round Mountain Gold Corporation to discuss the possibility of locating a radio site on their property. Several small hills above the eastern side of the valley, some as high as 1500 feet, were particularly attractive.

Named for the small nearby town of Round Mountain, which sprang up with the discovery of gold in the late 1800s, the mine has grown rapidly during the last 20 years to become one of the largest in the world. Mine officials, already considering communication improvements, quickly realized that participation in the new site would allow them to upgrade their outmoded simplex VHF radio system, and they provided access to a prime location. Because the site was low enough to allow some activity during the winter, construction of a tower, a shelter and utility service began in late 1997 and progressed rapidly.

NHP communications manager Mel Pennington contacted Telewave to provide antenna and combining equipment, as well as overall system design, based on several previous successful installations for his department. Pennington outlined his desire for a system that would cover the valley and its two-lane highway but would not waste power in unneeded directions. This ruled out the use of collinear or yagi antennas because of sharp nulls in their patterns and the problem of coverage overshoot close to the site. These antenna types would also cause severe multipath distortion in this environment because their highly compressed patterns would scatter signal power off the mountains. Another concern was the gain and bandwidth requirement. Existing (and future) users operated over a frequency range of more than 15MHz, and continuous radio coverage was needed over a minimum 75-mile span.

The combination of existing users and the need to allow for uncomplicated future expansion created a wide range of frequencies that could not be accommodated within one combiner or antenna system. A computer analysis also indicated significant intermodulation problems among several transmitters and receivers. As work began on the difficult task of minimizing interaction between transmitters while keeping signal loss as low as possible, our system engineers determined that the different transmit frequencies would have to be handled by at least two separate antennas.

This required the design of a transmit antenna array with four identical, horizontal



Sinclair Technologies Inc.
85 Mary St., Aurora, Ont., Can. L4G 6X5 Tel: (800) 263-3275 Fax: (905) 727-0861
55 Oriskany Dr., Tonawanda, NY 14150, U.S.A Tel: (800) 288-2763 Fax: (716) 874-4007

Sinclair Technologies Ltd.,
William James House, Cowley Rd, Cambridge CB4-4WX, U.K. Tel: +44 (0) 1223 42 03 03

SINCLAIR
http://www.sinctech.com

Circle (7) on Fast Fact Card

No Compromises Required with Andrew & Hutton!

Why compromise with other brands of corrugated cable? With imitators galore, Andrew HELIAX® remains the first choice of wireless communications carriers, dealers, system operators, and tower contractors throughout the world.

Now Hutton makes it easier for you to get fast, economical delivery of Andrew HELIAX® cable, antennas, and accessories. Our 8 strategically located warehouses can deliver Andrew products on-time to multiple tower sites to meet your rigid construction schedules. And because most of our U.S. warehouses are co-located with Andrew warehouses, we have access to a deep inventory of Andrew products.

There's no reason to compromise with another supplier of cable! Choose Andrew and Hutton for all your cable requirements.

HUTTON

Hutton Communications, Inc.

The First Choice in Wireless Distribution

Atlanta	Calgary	Chicago	Dallas	Denver	Harrisburg	Seattle	Toronto
800-741-3811	800-463-4793	800-435-9313	800-442-3811	800-726-6245	800-759-3031	800-426-2964	800-265-8685
Fax 770-963-7796	Fax 888-312-4444	Fax 800-284-4934	Fax 972-417-0260	Fax 303-371-5690	Fax 717-763-9144	Fax 425-485-5548	Fax 800-265-9414

Circle (8) on Fast Fact Card

www.huttoncom.com

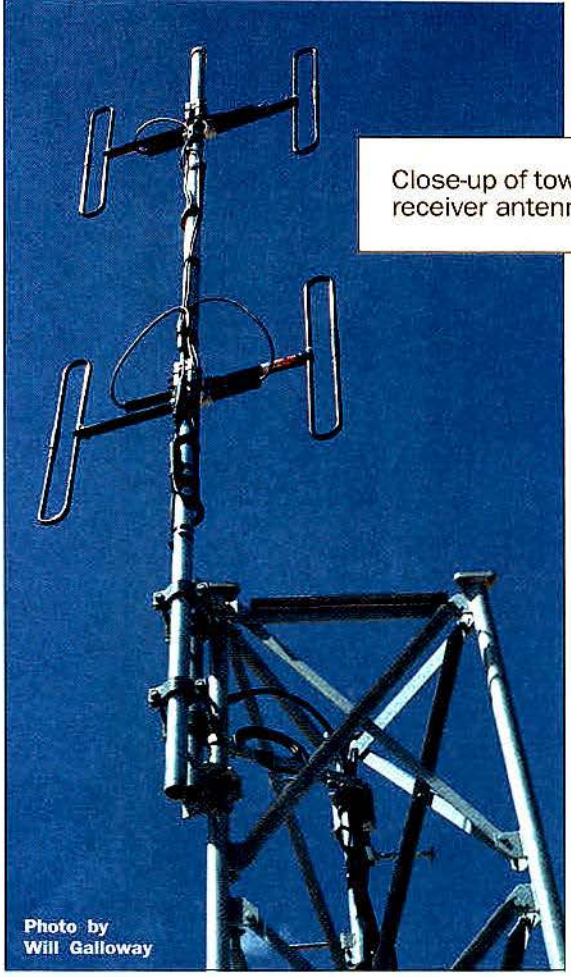


Photo by Will Galloway

Close-up of tower top showing receiver antenna array

bays mounted vertically, allowing selection of two non-interfering transmit frequency groups, handled by separate combiners. Although the use of hybrid combining would have simplified the design, the much higher loss of this type of combiner ruled out their use in the system.

The multibay antenna system is based on the ANT150D6-9 folded dipole array. The combination of medium gain, wide bandwidth and mounting flexibility made this antenna the only feasible choice. This specific dipole array is capable of creating custom radiation patterns for special requirements, and this was the critical factor for the Round Mountain site. The corporate feed system allows individual configuration of each element to create shaped coverage, reducing nulls and pattern distortion. Our antenna manager, John Hilmer, had to contend with both a relatively short 80-foot tower that created reduced isolation between transmit and receive antennas, and the unusual coverage requirements.

"Not only does the valley curve," Hilmer said, "but the highway bends right toward the antenna site, and the multipath off the mountains from a conventional antenna would have made this site unusable."

Using computer modeling and data gathered through hundreds of installations, we created a four-bay (two-by-two) transmit array that uses the tower to shape the radiation pattern and fits into a compressed vertical space to maximize separation from the receive system. The "coverage shaping" directs signal power up and down the highway and keeps multipath to a minimum.

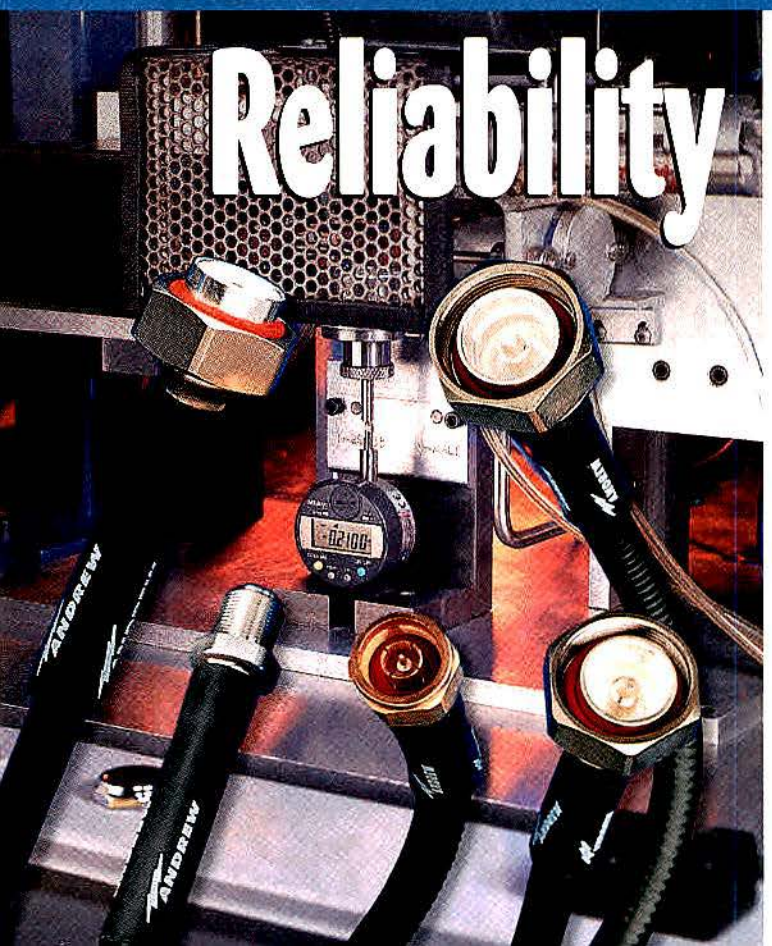
"The coverage of the antenna system is superb," said NHP's Pennington. "It's literally molded to the shape of the valley. Nothing is wasted, and we don't have any nulls anywhere on the highway."

Final system antenna gain is just over 8dBd, and received signal strength exceeds 50mV over most of the desired coverage area.

The combining system is based on M108-150 eight-channel VHF cavity-ferrite combiners. The main design goal of combining is always to control intermodulation.

Computerized frequency analysis allows the selection of two groups of channels that are fed to separate combiners and, in turn, to each of two transmit antenna arrays. The

Factory automated process ensures superior electrical performance



For Sure

New SureFlex™ factory made cable assemblies from Andrew combine maximum electrical performance with ready-made convenience.

Featuring a patent-pending, factory automated process that solders both inner and outer conductors to the connector, every SureFlex cable assembly promises 360° of electrical contact and a reliable weatherproof seal. No cable attachment O-rings. No sealants. Just consistent, robust attachment every time.
Other features include:

- Stable intermodulation distortion
- Consistent VSWR
- Accurate pin depth
- High pull off strength

For more details, call Andrew customer service today at:

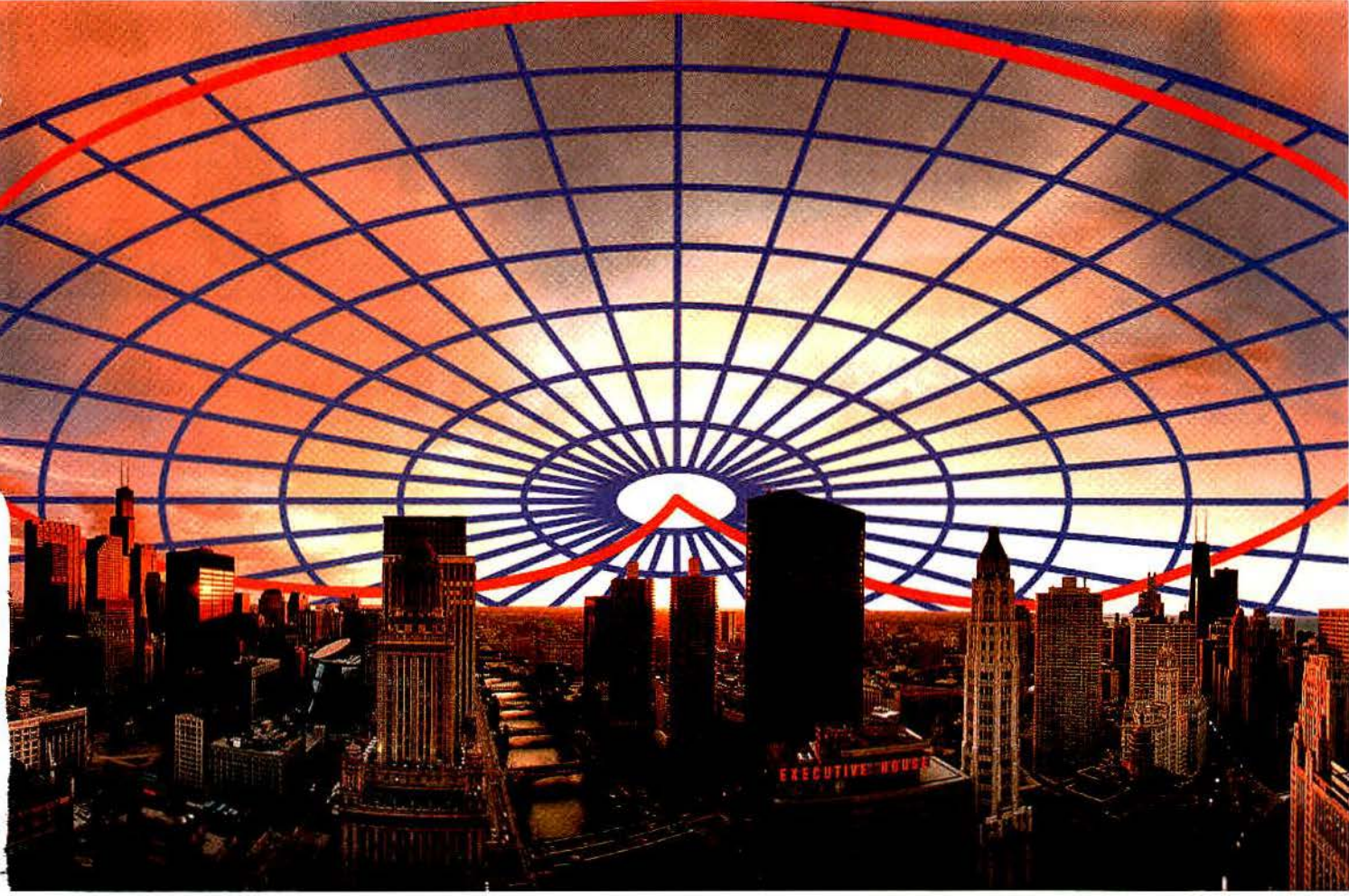
Call 1-800-255-1479 ext. 376
or Fax us at 1-800-349-5444

Visit our Web Site at
http://www.andrew.com

ANDREW®

In A Communicating World, Andrew Is Everywhere

Circle (9) on Fast Fact Card



Plagued By Co-Channel Interference?

You Need the New Celwave Maximizer.

CELWAVE
Maximizer™

The problem is persistent.

In cellular, PCS and EMSR applications, co-channel interference hampers system performance.

Reduce it — dramatically — with one of the new log periodic Maximizer™ antennas from Celwave.

At 45 dB, the Maximizer offers the highest front-to-back ratio in the industry. It features upper lobe suppression that reduces interference even when you're downtilting mechanically. And the Maximizer's heavy null fill delivers outstanding close-in coverage.

Competitive antennas cope with interference problems with varying degrees of success.

Brand "A" — popular in the 80s — has a front-to-back ratio of 28 to 30 dB. But many operators don't like its multi-rivet construction.

Brand "D" at 40 dB, has no rivets. But it does have a multitude of cables and soldered joints.

Compare these with the Maximizer, manufactured employing Celwave's exclusive CELlite technology: No rivets, no cables, no soldered joints.

The new **Maximizer** from Celwave.

We designed it to let you maximize your coverage.

But we wouldn't dream of interfering.

Write, phone or fax for additional information.

2 Ryan Road, Marlboro, NJ 07746-1899 • (908) 462-1880 • Fax (908) 462-6919
1-800-CELWAVE • International Sales (602) 252-8058 • Fax (602) 417-2124

CELWAVE®
DIVISION OF RADIO FREQUENCY SYSTEMS INC.

Maximizer is a registered trademark of Radio Frequency Systems, Inc.
©1997 Radio Frequency Systems, Inc.

Circle (10) on Fast Fact Card

smaller coverage requirement of the gold mine made it possible to further reduce transmitter interaction by placing RMGC's three repeaters on a third combiner and single bay antenna system, with room for expansion. Although only seven channels were installed for immediate use, other users occupying five additional channels were accommodated for future expansion, bringing the total to 12 channels. The lowest frequency will be used by local amateurs at 147.330MHz, and a weather service transmitter will operate at 162.550MHz. An FCC waiver allows the use of three marine ship-to-shore channel pairs for the mine repeater operations at 157/162MHz.

The receiver system also required special engineering for tight frequency spacing. An expansion receiver channel for the Nevada Division of Wildlife on 151.160MHz was affected by Nye County Public Works at 151.055 as well as a future NHP repeater, also in the 151 MHz band.

"UHF and 800MHz systems are relatively easy to design, because transmit/receive spacing is consistent, and receivers are high or low, depending on the band," said system engineer Bill Kubicki. "With a complex VHF system, the rules go out the window because frequencies are not assigned in standard pairs, and receivers often end up very close to transmitters."

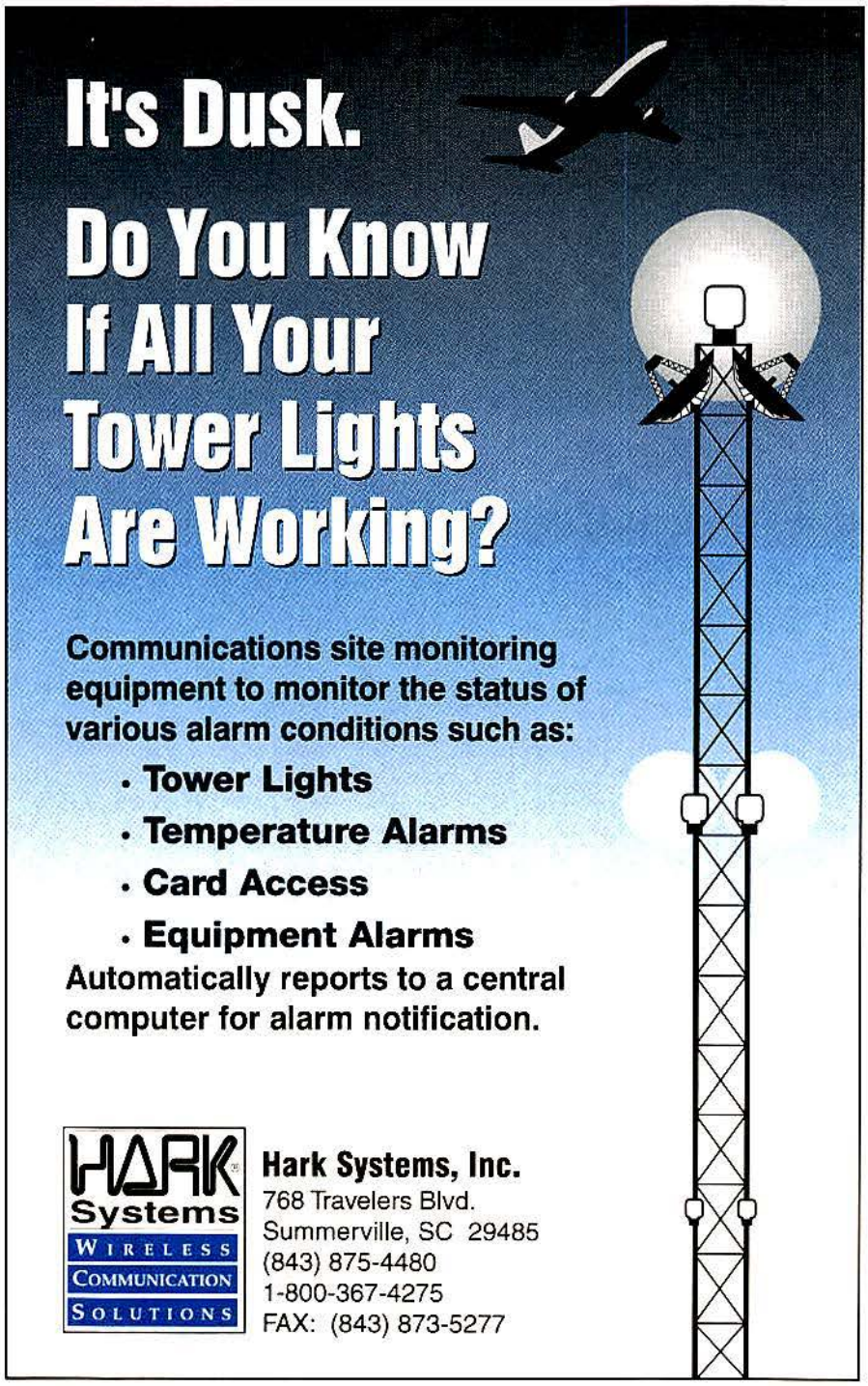
TWPC-1505-2 dual high-Q pass cavities were used for all receiver paths, with the addition of crystal filters for spacings of less than 100kHz. Low-noise amplifiers feeding power splitters allowed custom tuning of signal level to each receiver, fed by a 2-bay dipole array at the top of the tower.

For the gold mine, the separate antenna system composed of two single dipoles provides coverage of the entire 400-square-mile property, including the 1600-foot-deep main pit, an area of prime concern.

"The coverage for radios in the pit has always been a problem, and it got worse as we dug deeper," said RMGC Chief Engineer Dan Moore. "The new system allows even a 5W hand-held to talk out of the pit to any other part of our property." Potential commercial development of surrounding land owned by the mine also will be aided by improved radio communication.

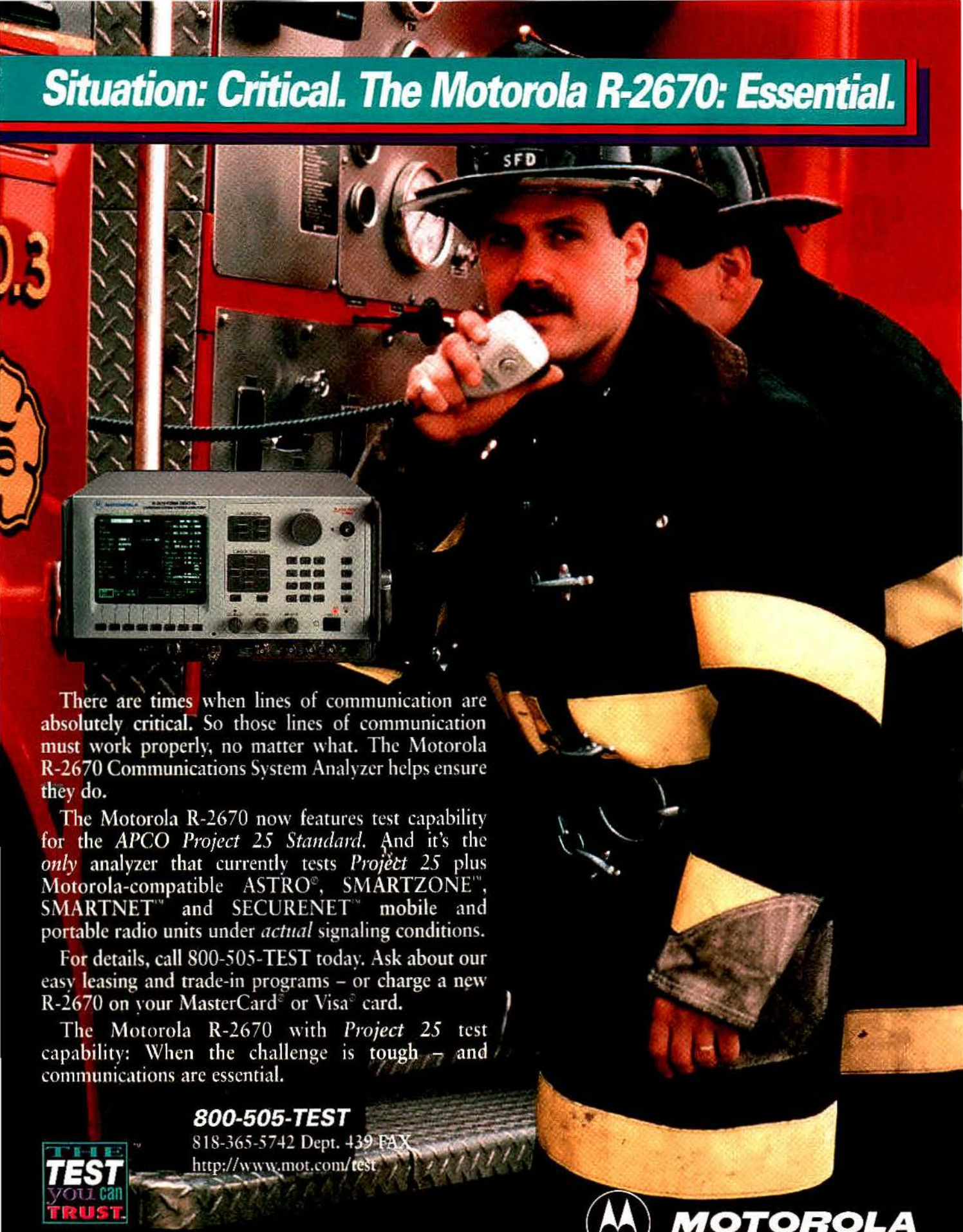
The cooperation of several organizations with similar goals has resulted in a successful and reliable radio communications site at Round Mountain. A new philosophy of site selection for year-round radio coverage has given the NHP, Nye County and RMGC an improved ability to provide public and private safety services to residents and mine employees. Cost savings to Nevada taxpayers, compared to a conventional mountaintop site, are considerable, both for initial development and ongoing operation.

The coverage of the valley is now better than before, with more consistent signal levels and greater penetration of previously shadowed areas. The lower site elevation has also eliminated interference to sites outside the valley, not to mention stormy snowcat rides, formerly a fact of life for users of the mountaintop. ■



Circle (11) on Fast Fact Card

Situation: Critical. The Motorola R-2670: Essential.



There are times when lines of communication are absolutely critical. So those lines of communication must work properly, no matter what. The Motorola R-2670 Communications System Analyzer helps ensure they do.

The Motorola R-2670 now features test capability for the *APCO Project 25 Standard*. And it's the *only* analyzer that currently tests *Project 25* plus Motorola-compatible ASTRO®, SMARTZONE™, SMARTNET™ and SECURENET™ mobile and portable radio units under *actual* signaling conditions.

For details, call 800-505-TEST today. Ask about our easy leasing and trade-in programs – or charge a new R-2670 on your MasterCard® or Visa® card.

The Motorola R-2670 with *Project 25* test capability: When the challenge is tough – and communications are essential.

800-505-TEST
818-365-5742 Dept. 439 FAX
http://www.mot.com/test

THE TEST you can TRUST.™

MOTOROLA

What you never thought possible.™

Motorola, ® and ASTRO are registered trademarks of Motorola, Inc. SMARTZONE, SMARTNET, "The Test You Can Trust" and "What you never thought possible" are trademarks of Motorola, Inc. All other marks and trademarks are the property of their respective companies. © 1997, Motorola, Inc. 6/97

Circle (21) on Fast Fact Card

Fred M. Link: 'Goodwill Ambassador'

Fred Link was known to several generations. His fame began with amateur radio exploits, continued with police radio innovations, included World War II radio manufacturing and extended with mobile radio consulting.

By Don Bishop

I met Fred M. Link in August 1984 at the Salt Lake City APCO conference. I was *Mobile Radio Technology*'s new senior editor. Phil Cook, then a co-owner of *MRT* and its publisher, invited a group for lunch, including Fred.

"Fred, what do you do?" I asked.

"Don, it's been so long since anyone asked me, I don't know how to answer," he responded.

You see, Fred was so famous in the land mobile radio industry that hardly anyone ever had to ask. What followed was about 20 minutes of Fred's resume, which sketched an amazing story.

My last visit with Fred was on June 8, 1998, when Mercy Contreras (*MRT*'s group publisher) and I took him to lunch at Loafer's Restaurant in Frenchtown, NJ. We talked about his friends in the industry and in the Radio Club of America. He passed away in his sleep on June 18 from a rapidly advancing leukemia that had been diagnosed only a few days before. He was 93.

Fred never wanted to cooperate in the writing of his biography. He wouldn't let me print his stories "while I'm alive," he said, "because I can't be sure what's the truth and what isn't. It might embarrass some people."

"But Fred, most of them are no longer with us," I persuaded.

"That's true, but I still can't be sure of what I say," he insisted.

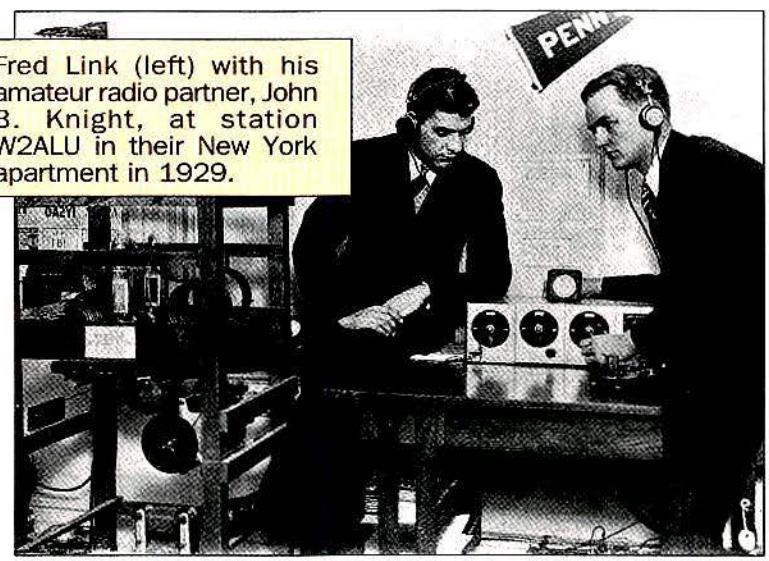
Early on, Fred worked part-time as a telegraph operator for the railroad. He was 14.

"I learned Morse code to earn a merit badge in 'wireless' to qualify as maybe the first Eagle scout in Pennsylvania," Fred explained. "A lot of the railroad's Morse operators had left for the military in World War I, so I got some work as a relief operator."

During high school, Fred worked for his uncle, George Motter, as an apprentice electrician.

"I attended school half-days and worked the other half," he said. Fred earned a Journeyman's Certificate as an electrician by the time he entered Pennsylvania State College.

He was a radio amateur, first with spark station 3OV at Boy Scout Troop No. 7 in the York, PA, YMCA, and then with his own continuous wave (CW) station, 3BVA. Access to electrical parts at his uncle's company helped Fred to build these stations. From 1927 to 1933, he and John B. Knight Jr. operated W2ALU in New York and Passaic, New Jersey.



Fred Link (left) with his amateur radio partner, John B. Knight, at station W2ALU in their New York apartment in 1929.

As a graduate electrical engineer in 1927, Fred went to work at New York Telephone and then, in 1929, DeForest Radio. In late 1931, Fred resigned from DeForest Radio along with a group of employees including the man who had hired him, Allen B. DuMont.

Fred had been in charge of tube manufacturing. A U.S. Navy radio inspector, Walter Peterman, suggested that Fred should consult the trustee of Duovac Radio Tube Company, Brooklyn, NY, to help the company to complete U.S. Navy orders for tubes. Fred did business for two years as "Fred M. Link, Consultant," with Duovac and other tube manufacturers. By 1933, Fred had become partners with R.C. Powell in the R.C. Powell Company, which manufactured remote broadcast amplifiers and radios.

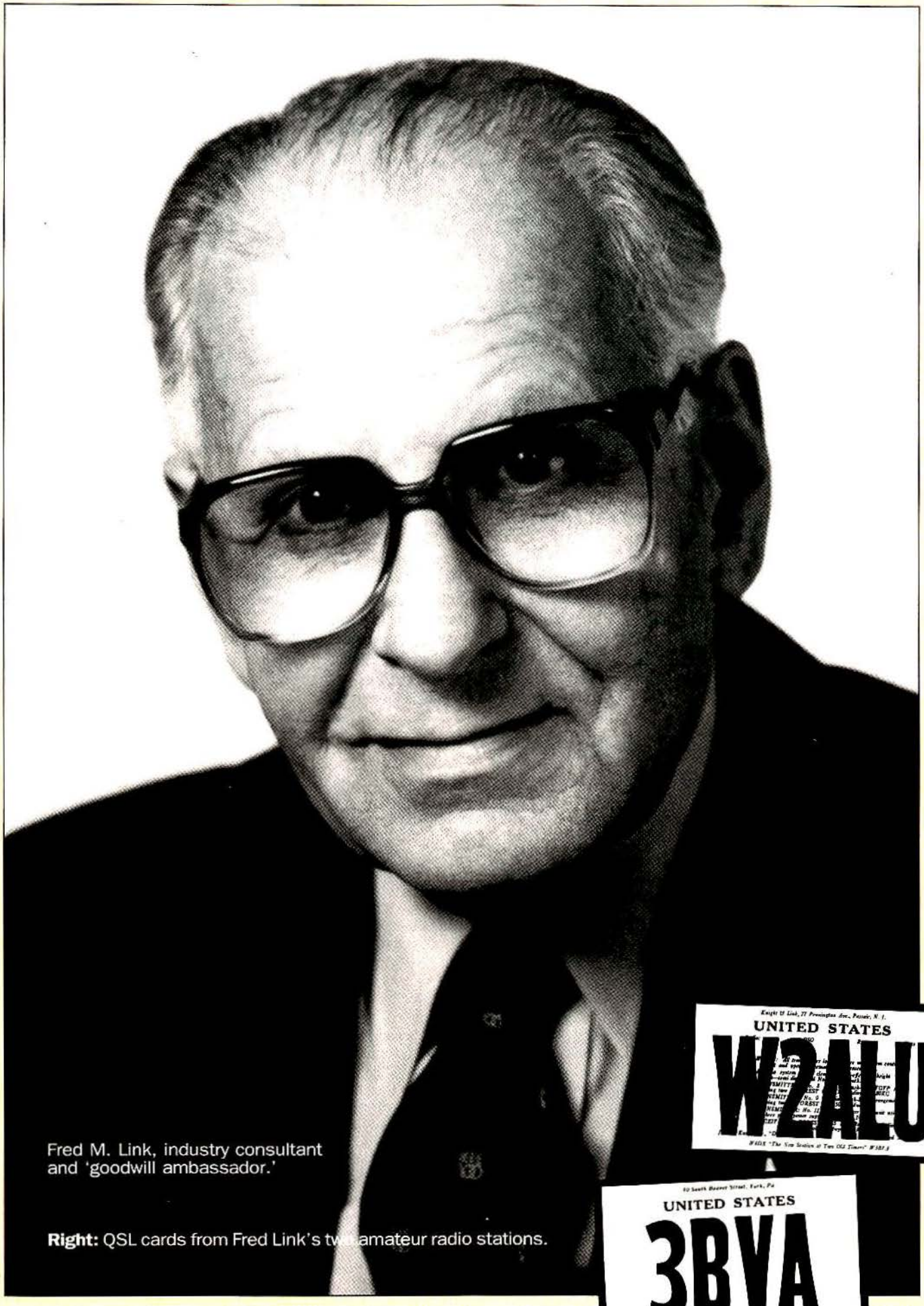
Once Fred told me he bought out Powell; another time he said Powell became overwhelmed by the business challenges of the Depression, turned the company over to Fred and left. Either way, Fred became sole owner, changed the name to "Fred M. Link Company" and went to work completing a Signal Corps contract for equipment.

The Link company made a variety of electronic equipment, assisted other manufacturers (including DuMont) and provided repair services before concentrating on police radio communications equipment under a new name, Link Radio Corporation. "Fred Budelman, our chief engineer, was brilliant," Fred said. "He could take circuit diagrams, think about them overnight, and build prototypes the next day."

What put Link Radio in the forefront was the manufacture of frequency-modulated (FM) two-way radio equipment.

"That was the brainchild of Dan Noble, an electrical engineering professor at the

Bishop is editorial director.



Fred M. Link, industry consultant and 'goodwill ambassador.'

Right: QSL cards from Fred Link's two amateur radio stations.

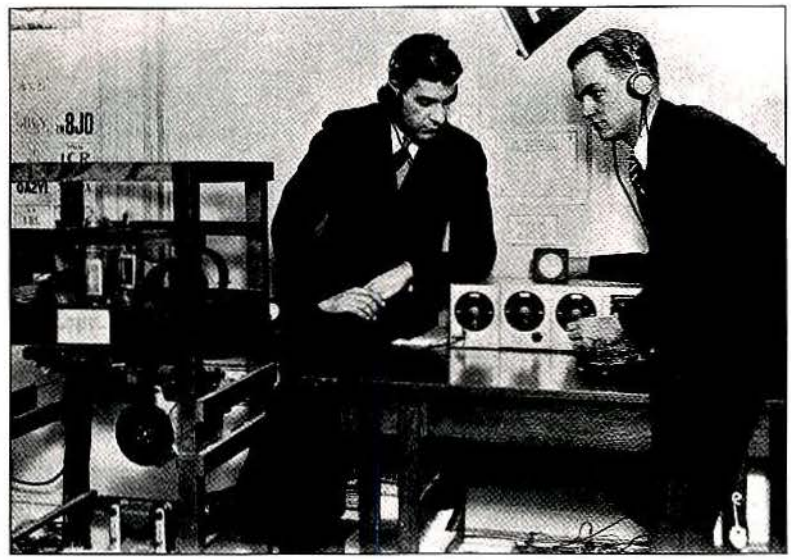
University of Connecticut," Fred said. "He was consulting the state police on the design of a statewide communications network."

Noble had monitored experimental FM broadcasts from Edwin H. Armstrong's Alpine, NJ, station, and had developed an idea for using FM for communications.

"Noble visited Link Radio with diagrams and showed them to Budelman and me," Fred said. "The next day, Budelman had prototypes." Link Radio then built the Connecticut equipment.

With FM, Link Radio took the lead in police radio manufacturing, and later made equipment used by all military branches during World War II. His company earned five Army-Navy "E" awards. In 1950, Fred sold the company.

"I had been lucky many times," Fred said, but luck ran out with the sale of the business. His buyers gave him preferred (non-voting) stock. "I didn't need the cash," Fred said. His buyers came under federal indictment for reasons I never learned and diverted company resources to pay their legal expenses. Link Radio was in Chapter 11 bankruptcy by 1952 and was liquidated in 1953. Fred went back to work.



In 1954, under a five-year contract with DuMont Laboratories, run by his old friend Allen DuMont, Fred established a mobile radio division and hired many former Link Radio employees. The division served many former Link Radio customers that had been left without replacement equipment and service.

After the contract was up, Gen. David Sarnoff, the head of Radio Corporation of America (RCA), told one of his vice presidents to hire Fred as a consultant to resolve a problem with an RCA contract to provide police radio equipment to the city of Philadelphia. The Sarnoffs had met the Links on a cruise ship, and Sarnoff knew Fred by reputation and because Fred had helped to prepare compelling legal exhibits in opposition to RCA in a patent dispute. More luck?

"Sarnoff told this vice president how much I was to be paid, and it was more than the vice president made. He didn't like that very much," Fred said. Fred's help saved the contract, and Sarnoff kept him as a consultant from 1959 to 1965.

After 1965, Fred worked as a consultant for a variety of companies. One was Cambridge, England-based Pye Telecommunications, which became part of Philips Radio Communications Systems, which is now Simoco Telecommunications. Another was Communications Industries, one of whose founders, Jerry Stover, credits a Link radio with saving his life in World War II—somewhat for its communications capability, and somewhat for its capacity to stop bullets, as Jerry tells the story.

Others to benefit from Fred's expertise included Repco, E.F. Johnson, Ericsson, Trott Communications Group and ... *Mobile Radio Technology*. Fred became our industry consultant in 1984. He advised us about information we should publish and introduced us to industry figures he thought we should

Continued on page 68

'They tell me I was magnificent!'

Fred M. Link was my mentor and my good friend. My life was enriched by his friendship, and I shall forever cherish the memories of our many wonderful times together.

Fred passed away on June 18, 1998. It was a sad day for all of us in the land mobile industry. Fred was revered as the "father of two-way radio." Hardly a person in the industry didn't know Fred personally or by reputation. Fred was 93 when he passed away. His age, though, never stopped him from being as involved in the industry as his health would permit. As recently as the first week in June, Fred signed some letters announcing his resignation from the Radio Club banquet contributions committee. Committee? He *was* the committee! And until June 18, 1998, Fred was industry consultant to *Mobile Radio Technology*.

I am reminded of the wonderful times I shared with Fred. He once chastised me for not being present at one of his many keynote speeches.

"They tell me I was magnificent!" he proclaimed with a straight face. And I have no doubt that he was. Fred was quite a gifted speaker. For years he was the featured speaker at the Radio Club of America breakfasts, and how we looked forward to his presentations. We sat there mesmerized by his stories about Silver Dollar Jim West or about the time he and Johnny Knight entered a DX contest and transmitted from their room at the New York City YMCA with bootlegged power from an elevator. Their operation caused so much interference to AM broadcast radio reception that authorities traced the source to their room. Fred had so many wonderful experiences to share. Remember his many adventures with Bill Lear, and how he met Nikola Tesla? Fred would stray from his story, and maybe take two or three digressions, but he always tied everything together in the end. Part of the fun of listening was wondering how in the world he would tie what he was talking about to what he had started to talk about in the first place.

As my friendship with Fred grew, so did my relationship with his lovely wife, Mildred, and his daughter, Joanne. Fred and Mildred are affectionately called "Dazzy" and "Memi" by their children, grandchildren and close friends. Memi and Joanne share Fred's wonderful sense of humor, amazing energy and ability to make you feel like you are their best friend. I asked Memi if there was anything we could do for her. She said she would like to have a collection of Fred's "one liners." If you knew Fred you know of his special, and sometimes not too humble, way of saying things. Memi always got a kick out of hearing about them and would like to have a collection of them in remembrance of Fred. If you have any stories you would like to share with Memi please send them to me at *Mobile Radio Technology*, or you can email them to *mercy_contreras@intertec.com*. We would love to be able to give Memi a nice collection of "Fred stories."

In one of my last conversations with Fred, I told him that things were just not the same without his full involvement. I told him that we were trying to carry on like he expected us to, but that it would never be the same. His "one-liner" response was; "Well, *that* can't be denied, *that* can't be denied."

Dazzy, you were special, and we will miss you terribly. There will never be another quite like you. And *that* can't be denied, Dazzy. *That* can't be denied.

—Mercy Contreras
Group Publisher

CONNECT WITH THE BEST

FLEXWELL® Foam-Dielectric Coaxial Cable and Connectors

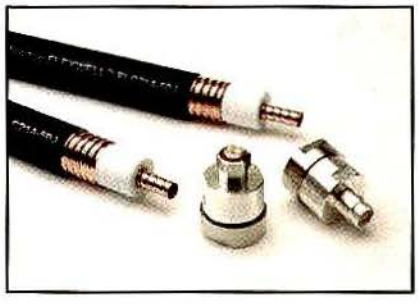
Superior Performance,
Maximum Flexibility

and Waterproof too!

FLEXWELL cable features a copper corrugated outer conductor providing the superior performance you need along with maximum flexibility for ease in installation.

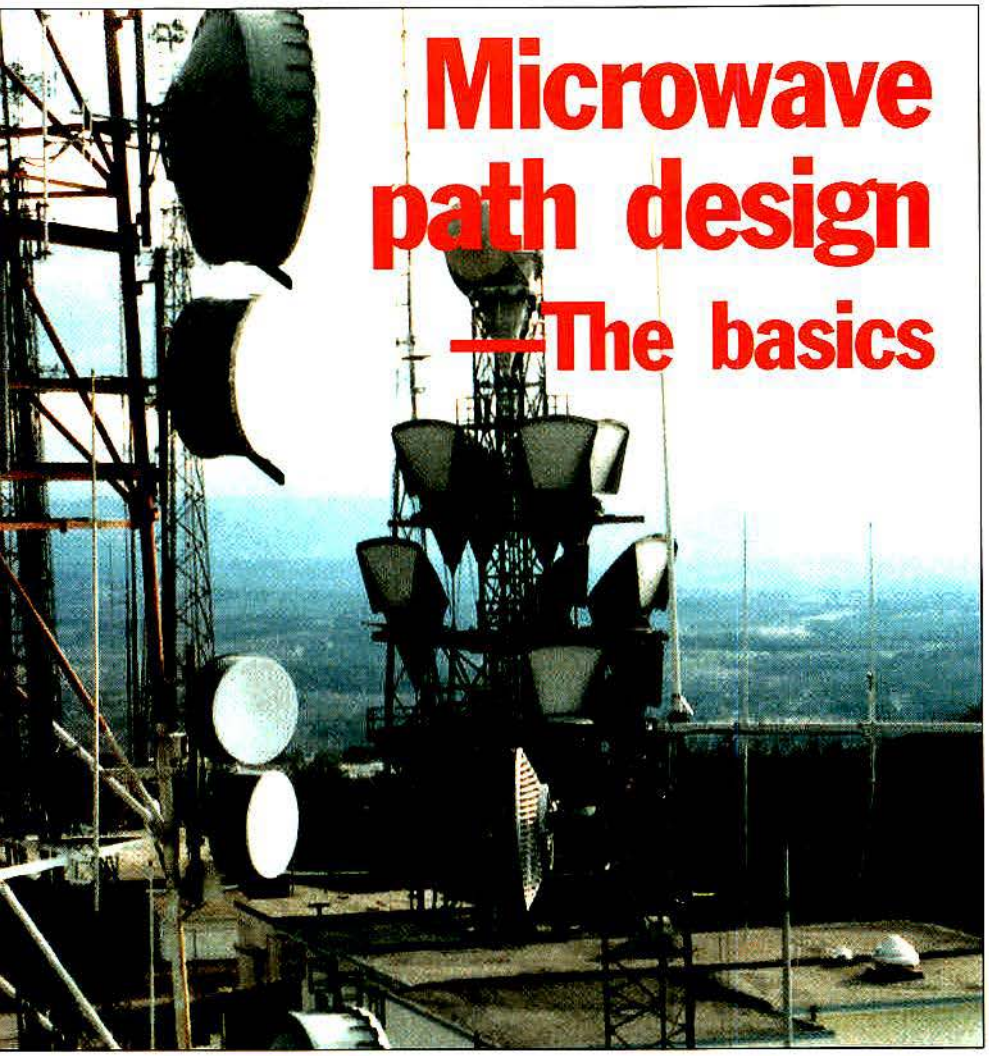
The proprietary closed cell design of the foam in *FLEXWELL* foam-dielectric coaxial cable coupled with RFS Cablewave's waterproof connectors ensures a uniquely waterproof system.

Proven performance is why, more and more, the wireless industry's preferred choice is RFS Cablewave's *FLEXWELL* coaxial cable, connectors and installation accessories.



RADIO FREQUENCY SYSTEMS
RFS Cablewave
60 Dodge Avenue, North Haven, CT 06473
Phone (203) 239-3311 Fax (203) 234-7718
www.cablewave.com

Circle (22) on Fast Fact Card



Microwave path design —The basics

Part 4—This series of four articles is a primer on some of the propagation-related basics of microwave path design. This last installment discusses path reliability.

By Jeff Ashley

Preceding installments in this series have described basic considerations:

- Determining whether a proposed path is "line-of-sight."
- Evaluating path clearances with regard to refractive effects.
- Evaluating path clearances with regard to Fresnel zones.
- Considering path reflections.
- Deriving a power budget and fade margin.

This concluding article covers path reliability.

Path reliability

Usually, microwave links are designed to meet a specific reliability factor. Reliability may also be termed "availability" and is expressed as a percentage. It represents the percentage of time the link is expected to operate without an outage caused by propagation conditions. The Bell standard for short-haul propagation reliability is 99.995% (minimum), while requirements for high-capacity, long-haul may be 99.9999%. "Unavailability" or the probability of an *outage* (because of propagation conditions) is often referred to and, if expressed in percentage, the value is determined by subtracting the availability (expressed as a percentage) from 100. For example, a short-haul reliability (availability) factor of 99.995% can also be expressed as an *unavailability* factor of 0.005%.

Availability and unavailability are referenced to a year. In other words, if the unavailability is 0.001%, it could also be stated there will be:

$$365.25\,(\text{days / yr}) \times 24\,(\text{hr / day}) \times 60\,(\text{min / hr}) \times \frac{0.001}{100}$$

= 5.26 minutes of unavailability (outage) *per year.*

The propagation-related unavailability is derived from Equation 1 below. This equation is used as an approximation for the one-direction effects of multipath fading with various terrain and atmospheric conditions.

$$P_m = a \times b \times 2.5 \times 10^{-6} \times f \times D^3 \times 10^{-F/10} \qquad \text{[Eq. 1]}$$

where

P_m = Outage probability (unavailability) due to multipath fading.
D = path length (in miles).
f = frequency (in GHz).
F = fade margin of the path (in dB).
a = one of the following generalized terrain factors:
- 4: very smooth (including water).
- 1: average, some roughness.
- 1/4: very rough.

b = one of the following generalized climate factors:
- 1/2: hot, humid.
- 1/4: normal, temperate.
- 1/8: very dry.

(Note that the result of this equation must be multiplied by 100 in order to be expressed as a percentage.)

Another factor that can affect path reliability is rain attenuation, particularly past 10GHz. At these higher frequencies, the wavelength becomes short enough that rain droplets (depending on their size and shape) can present themselves as obstructions to the path. This occurs when the diameter of the droplets approach 1/4 wavelength of the frequency being used. The maximum instantaneous intensity of the rainfall and the percentage of the total path within the rain cell are other factors to be considered.

Because rain rates differ by geographic location, statistics for the particular area of interest must be obtained. Commercial path design software typically has this information in tables, requiring the user simply to select the geographic location of the proposed path. The values for that area are then accessed. The National Weather Bureau also maintains this information for various cities throughout the United States.

Increasing path reliability

One method of increasing path reliability is to increase the fade margin. If the

Ashley is a communications technician in Los Angeles.

It's Time to Perform.

KENWOOD.
FIFTY YEARS OF
ENGINEERING...
FOR SITUATIONS JUST
LIKE THIS.

The true test of your 2-way radio is in an emergency situation. This is when you know you can depend on Kenwood. All Kenwood radios are durable, with rugged Mil Spec construction. They're easy to use with convenient and versatile features.

Call us about our TK-230/330 portable with a channel group selector knob for choosing new channels on the fly and enunciator tones so you hear all channel changes. Like our full line of mobiles and portables, the TK 230/330 meets or exceeds military and industry standards in 13 categories. You can feel, hear and see the difference Kenwood makes when it counts.

KENWOOD
SINCE 1946
50th ANNIVERSARY

KENWOOD
ALWAYS COMES THROUGH

ISO 9001
JQA-1205

KENWOOD COMMUNICATIONS CORPORATION • FAX (310) 761-8246 • http://www.kenwood.net

CALL FOR YOUR FREE PRODUCT GUIDE: 1-800-950-5005

Circle (23) on Fast Fact Card

design engineer dictates a particular fade margin requirement from the start, the power budget can be determined in a particular sequence. Knowing the noise threshold of the receiver being used (-dBm) and the required fade margin, the nominal signal level into the receiver can be determined (noise threshold [-dBm] plus fade margin [+ dB] = nominal receive level [-dBm]). The difference in decibels between the transmitter RF output level (+ dBm) on one end of the path and the desired receive signal level (RSL) on the other end of the path will be the maximum allowable net path loss. Because path distance and antenna heights are known, free space and atmospheric losses, along with all hardware losses on both ends, can be determined and will exceed this allowable net path loss by some amount (measured in decibels). The amount by which it is exceeded will be the necessary combined gain of the antennas on each end of the path. To achieve this required gain, proper antenna reflector diameters must be selected.

Parabolic ("dish") antennas typically have gain efficiencies of 55% to 65%. Using an efficiency of 55%, the gain of a parabolic antenna can be calculated as follows:

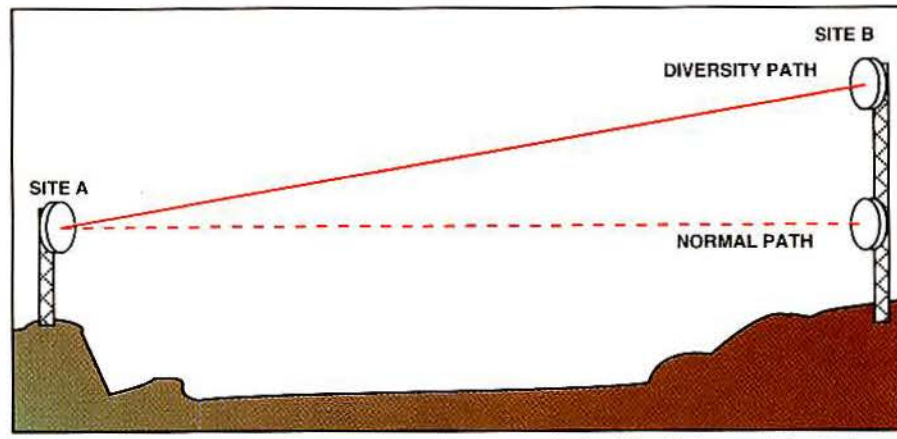


Figure 1. With adequate spacing between antennas, there should be little correlation between paths with regard to fading.

$$G = 20 \log_{10} B + 20 \log_{10} F + 7.5 \quad \text{[Eq. 2]}$$

where

G = gain over an isotropic antenna.
B = parabola diameter in feet.
F = frequency in GHz.

After a proposed microwave path has been evaluated with regard to reliability, the calculations may show that it will not meet the required standards. In such situations, additional techniques known as *diversity* methods may be employed.

One such technique is *space diversity*, which involves the addition of another receive antenna, separated in distance from the first, as shown in Figure 1 above. An additional receiver and associated switching/combining equipment will also be needed. The additional "diversity" antenna is usually mounted on the same tower structure, yet vertically separated from the site's original receive antenna. This diversity antenna is connected to the diversity receiver. This additional equipment essentially creates another microwave path between the two sites. Receiver switching and combining equipment then senses which receiver has the troubled signal (if fades occur) and switches that receiver "off-line."

Constructing a UHF Trunking System?

Build it "Smart" with the Ritron RRX-450 Synthesized Repeater.

Call us at 800-USA-1-USA or FAX 800-251-RFAX and find out about the smart solution for your UHF trunking system.

Easy Interface to Trunking Controllers!

RITRON,® INC.
Wireless Communications Products and Systems

UHF trunking is a smart idea. It's spectrum efficient and has plenty of profit potential for an operator. But don't stop there. If you're constructing a system or planning to soon, build your system "smart" with Ritron's RRX-450 synthesized repeater.

The RRX-450 repeater is the intelligent choice because it offers so much for so few dollars. For starters, it easily connects to trunking controllers through a dedicated internal connector, eliminating interface hassles.

The RRX-450's superior technical performance is well suited for trunking environments. It has excellent transmit modulation bandwidth and linearity, allowing trunking control data to pass through cleanly without any distortion. And it can easily drive a 100 Watt power amplifier with 6 Watts of input and still operate at continuous duty.

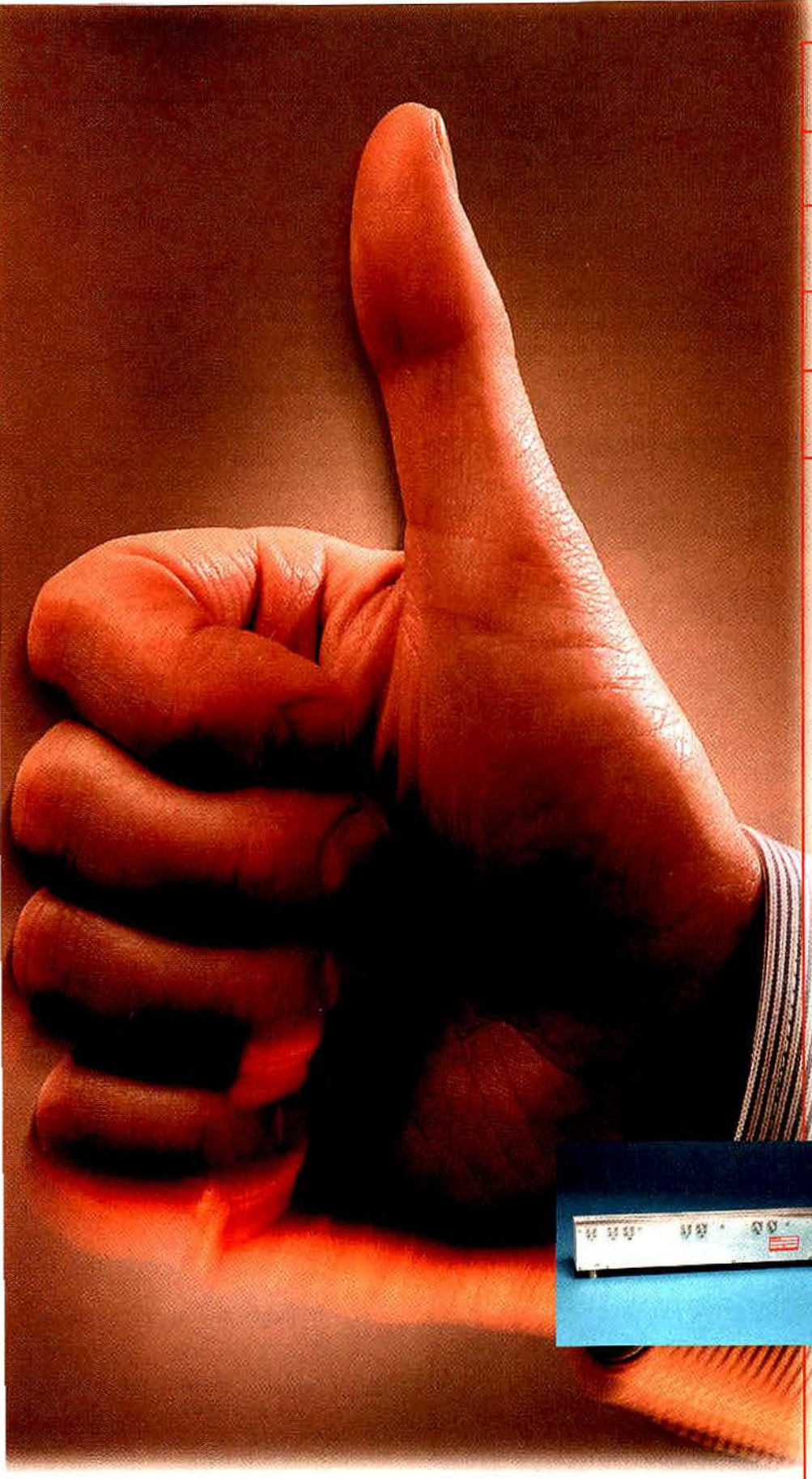
All of these features make Ritron's RRX-450 the competent choice for your trunked radio system at a cost that's hundreds of dollars below the competition:

- 10 pin trunking controller interface
- Ventilated rack mount enclosure with cooling fan
- UHF and VHF* Models
- 8 & 30 Watts output power
- 110/220 VAC operation
- CTCSS/DCS Signalling
- 12 VDC trickle charge w/Auto cutover
- Flexible PC Programming

* FCC type acceptance pending (available for international sale)

MADE IN THE USA

Circle (24) on Fast Fact Card



Is it possible to boost base station RF output over 12% without redesigning your amplifiers?

Yes–with the Narda low-loss Switchable Divider/Combiner. It's the only device that significantly increases convenience and optimizes signal power for your base station by combining a signal divider, a switch and a combiner all in one unit.

But what makes this device especially unique is its output switching ability for as many as four amplifiers. During operation, the logic-controlled patented switch combiner maximizes flexibility, and minimizes RF path loss, by automatically configuring the device to accommodate the number of on-line amplifiers in the most ideal way. The amplifier outputs are combined into one high-power, low-loss output of up to 250 watts CW.

Narda's Switchable Divider/Combiner achieves all this with a combined insertion loss <0.5 dB and a VSWR <1.4:1 regardless of the number of combined inputs.

Without our multi-function device, you're faced with both inconvenience and the loss of power. Not to mention the fact that you miss out on the thumbs-up reliability built into every quality Narda product.

To find out more, call us at **516-231-1700.** Or call our Faxback and ask for document 1119 at **1-800-4NARDANY.**

ISO9001

© 1998 L-3 Communications, Inc.

narda
microwave-east
an L3 communications company

It's Narda to be precise.

Circle (12) on Fast Fact Card

One drawback of space diversity is increased cost. Tower heights must be greater to achieve sufficient vertical antenna separation. In some cases, the existing tower structure might have to be retrofitted to handle the additional wind loading created by the diversity antenna. The diversity antenna, receiver and combining and switching equipment create additional cost.

When spacing is adequate between antennas, there should be little correlation between the two paths with regard to propagation characteristics. Improvement in reliability comes from the reduced probability that both paths will be adversely affected by fading at the same time.

In general, more vertical spacing between antennas offers less path correlation and better path reliability. The rule of thumb for antenna spacing is as follows: 60–80 feet at 2GHz, 45–50 feet at 4GHz, 30-40 feet at 6GHz and 25–30 feet at 11GHz.

The following modified form of Arvids Vigants' fade reduction factor equation can be used to estimate the improvement offered by space diversity:

$$I_{sd} = \frac{7.0 \times 10^{-5} \times f \times s^2 \times 10^{F+10}}{D}$$

[Eq. 3]

where

I_{sd} = improvement factor (space diversity).

f = frequency in GHz.

s = vertical antenna spacing, in feet, between centers.

D = path length in miles.

F = path fade margin (if one antenna's path has a smaller fade margin, use that figure).

Frequency diversity is another method used to increase path reliability. Microwave transmitters operating on two frequencies (with a typical in-band diversity spacing of about 2%), and sometimes in two frequency bands (called crossband diversity), are used to transmit the same information to separate receivers at the other end of the path.

Reliability improvement comes from the reduced chances of fading occurring on both frequencies (or frequency bands) at the same time.

Frequency diversity does not require the vertical antenna spacing used in space diversity, and therefore reduces tower cost. It does, however, require the use of more spectrum because it uses two sets of frequencies.

Because available frequencies are in limited supply, the FCC disallows the use of frequency diversity except under certain conditions. Test comparisons between space and frequency diversity indicate that improvements realized with space diversity are generally greater than those achieved with frequency diversity.

A general formula to calculate the improvement factor given by frequency diversity is as follows:

$$I_{fd} = K \times \left(\frac{\Delta f}{f}\right) \times 10^{F+10}$$

[Eq. 4]

where

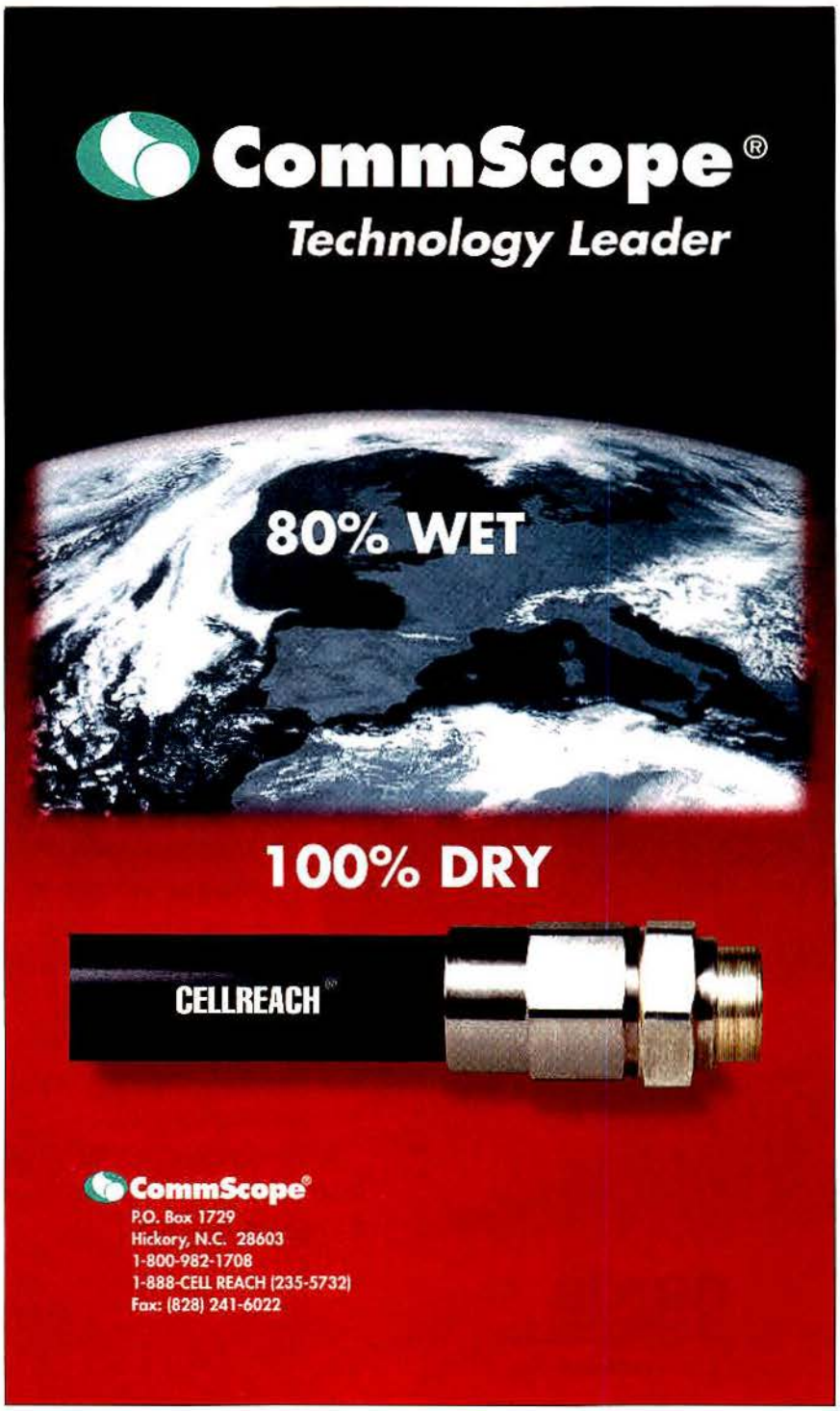
I_{fd} = frequency diversity improvement factor.

$\frac{\Delta f}{f}$ = frequency diversity spacing (*percent* ÷ 100).

F = fade margin.

K = 1/2 for 4 GHz band.
1/4 for 6 GHz band.
1/8 for 8 GHz band.
1/12 for 12 GHz band.

(The values of K shown above for the 8GHz and 12GHz bands are GTE-Lenkurt engineering estimates based on work from



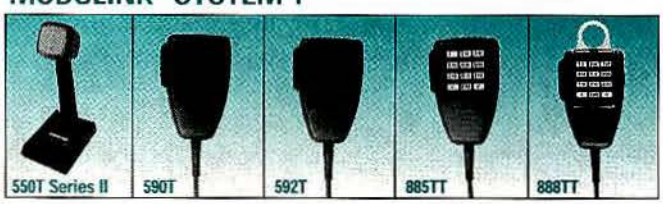
Circle (13) on Fast Fact Card

ALL THE RIGHT CONNECTIONS.

more cordsets added!

Now compatible with even more radio transceivers! Including Ericsson MDX/Orion and Icom.

MODULINK® SYSTEM 1



550T Series II	590T	592T	885TT	888TT
Transistorized base station with split-bar monitor transmit switch	Transistor amplified dynamic	Electret condenser with noise-canceling pick-up	DTMF with continuous-tone dialing and illuminated keypad	Aircraft DTMF, noise-canceling and FAA certified

Shure ModuLink® handheld microphones connect easily to virtually all popular radio transceivers with no hardwiring. Simply snap the correct cordset into the Modulink microphone and the transceiver. And in just 30 seconds, you're ready to roll.

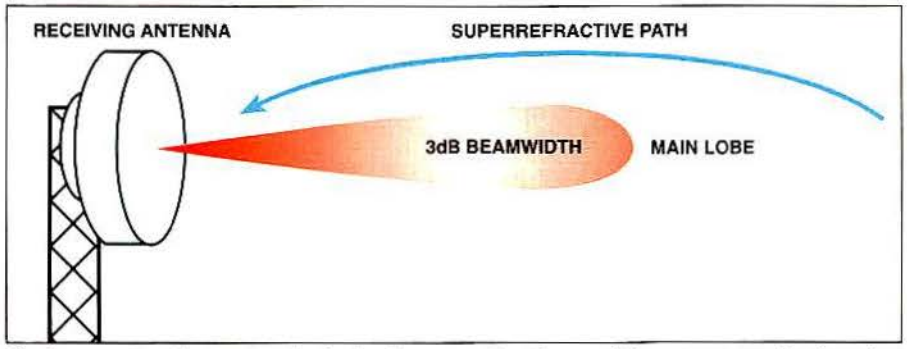
ModuLink® saves service time, reduces downtime and inventory costs, as well as all the quality you've come to expect from Shure.

For more information on how you can make all the right connections with Shure ModuLink System 1, call 1-800-25-SHURE.

SHURE®

The Sound of Professionals...Worldwide.®

Circle (14) on Fast Fact Card

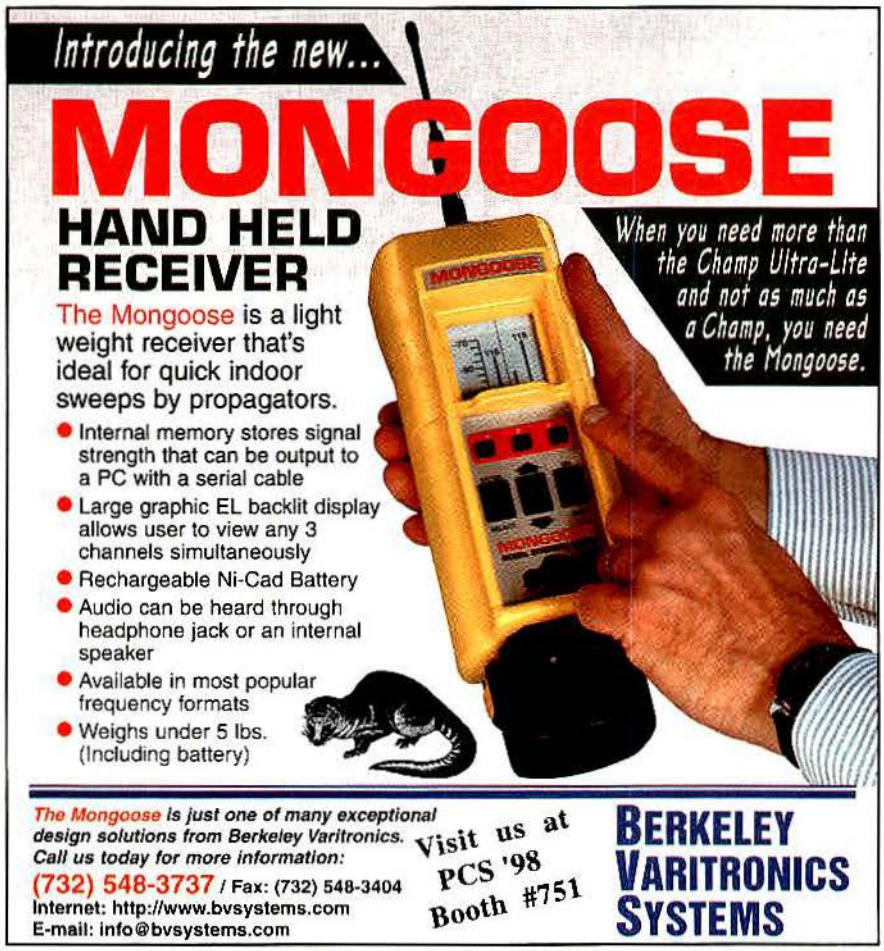


The increased vertical angle of arrival under superrefractive conditions may cause the incoming wavefront to fall outside the beamwidth of the antenna. This is called 'antenna decoupling' and can cause a significant reduction in receive levels.

W.T. Barnett that dealt strictly with the 4GHz and 6GHz bands.)

Neither space diversity nor in-band frequency diversity provide improvement against rain attenuation, although out-of-band frequency diversity (such as 6GHz/12GHz) does.

Under superrefractive atmospheric conditions, negative values of K can exist where the path bows skyward at mid-path and comes downward at the ends. This will create a wavefront that will arrive at the antenna with a greater vertical angle than normal (see Figure 2 above). Because microwave antenna beamwidths can be small, this increased vertical arrival angle may be outside the antenna's half-power beamwidth. The received signal level realized may be sufficiently low to cause noise problems or even an outage. This has been termed "antenna decoupling." A method of reducing this effect is to use a special *angle diversity* feed horn arrangement that essentially creates two vertically separated main lobes, so that if the signal level from the lower (normal) main lobe diminishes sufficiently because of the wavefront's increased arrival angle, the other (upper) lobe will be better oriented. Because most fades are due to reflections and multipath effects rather than this anomalous superrefractive condition, angle diversity offers only a limited improvement factor over that of a non-diversity path under typical path conditions.



Circle (15) on Fast Fact Card

Hybrid diversity is where both frequency *and* space diversity are employed simultaneously. However, most of the improvement comes from the effect of the space diversity.

The following equation is used when calculating fade probabilities with various methods of diversity:

$$U_{div} = \frac{P_m}{I}$$

[Eq. 5]

where

U_{div} = unavailability or probability of outage (using some diversity method).

P_m = annual unavailability (non-diversity) due to multipath (Eq. 1).

I = diversity improvement factor (Eq. 3 and Eq. 4).

In multiple-hop microwave systems, the overall reliability figure (expressed as a percentage) is obtained by taking the sum of the unavailability figures (as a percentage) for each hop, and subtracting that figure from 100.

Conclusion

Many other considerations go into the complete design of a microwave path and communications link. Additionally, each of the points discussed can be taken in much greater depth. Volumes of information are available to the interested reader from many of the large communications companies, both past and present.

This series of articles has offered a glimpse into some of the more fundamental propagation-related design considerations and will be of value to those just getting their feet wet in the microwave communications field. ■

References

"Antenna Decoupling," GTE-Lenkurt *Demodulator*, March/April 1978.

Laine, R.U., "Determining Antenna Heights for Coastal Areas," Lenkurt Electric, Monograph 197.

Llanes, Cesar L., "6-Gigahertz Space-Diversity Digital Microwave Test Link," Los Angeles County Internal Services Department, ITS Engineering Study, Los Angeles, Nov. 1989.

"Multipath Fading," *Demodulator*, GTE-Lenkurt, Nov. 1967.

"Space Diversity," GTE-Lenkurt *Demodulator*, May 1973.

White, R.F., *Engineering Considerations for Microwave Communications Systems*, 4th Ed., GTE-Lenkurt, San Carlos, CA, 1983.

Acknowledgments

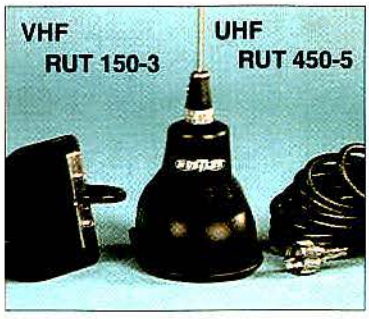
A special thanks to Cesar Llanes for answering so many questions through the years.

Down in Texas we know what mobile communication is all about...

NMO Mount
Magnetic Mount
Trunk-lip Mount

VHF • UHF
800/900 MHz
Low Band
Cellular • Paging
Mobile Dispatch • GSM

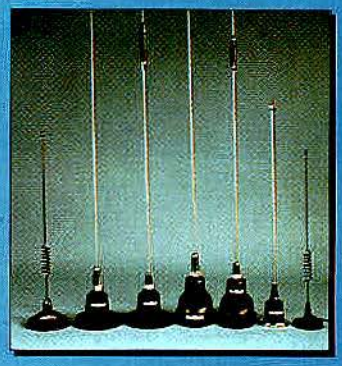
...and *HUSTLER* has the right mobile antenna for your project anywhere in the world.



HUSTLER®

"Beyond Your Expectations"

MOBILE ANTENNAS
25-960 MHz



New-Tronics Antenna Corporation
One Newtronics Place
Mineral Wells, Texas 76067
(940) 325-1386 Fax (940) 328-1409
E-mail: hustler@txol.com
TOLL FREE ORDER LINE
(800) 949-9490
Dealer Inquiries Welcome
Circle No. 30 on Card.

Reinventing antennas

An effort to design a wideband antenna for trunking leads to an interesting new tool for multiple applications.

By Don Simon and Jack Daniel

Every now and then, a truly new concept comes along. This antenna is a major innovation.

Dan Kaegebein, principal engineer and one of the founders of TX RX Systems, sought to develop an antenna that would match the broadband capabilities of his patented "T-Pass" transmitter combiners.

Although the unit can combine channels over frequencies ranging from 800MHz to 960MHz into a single transmission line, there were no high-performance gain antennas that could match this wide bandwidth. This new antenna design is flat from 806MHz to 960MHz.

While trying to solve the bandwidth problem, Kaegebein created an antenna with secondary features desirable for most systems operating in the 800/900MHz bands.

We will use the 806MHz-to-960MHz wideband, 8dB-gain, omnidirectional antenna as an example.

Corporate-fed arrays

The new antenna uses "corporate (parallel) feed" to drive its eight vertically stacked dipoles, as shown in Figure 1 at the right.

Corporate feed distributes power equally to all elements, which allows for a wide beamwidth. However, it is difficult to construct antennas using corporate feed. The familiar folded-dipole arrays are the most common example. Unfortunately, all of the cable connections are exposed to the weather with

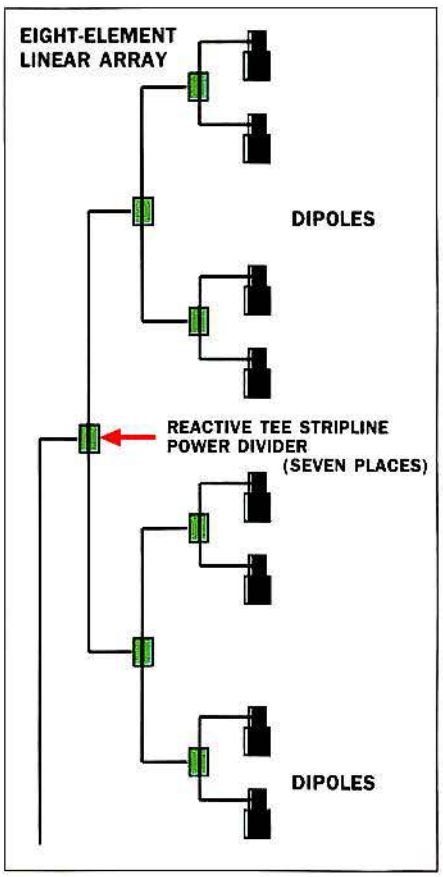


Figure 1: Corporate feed diagram.

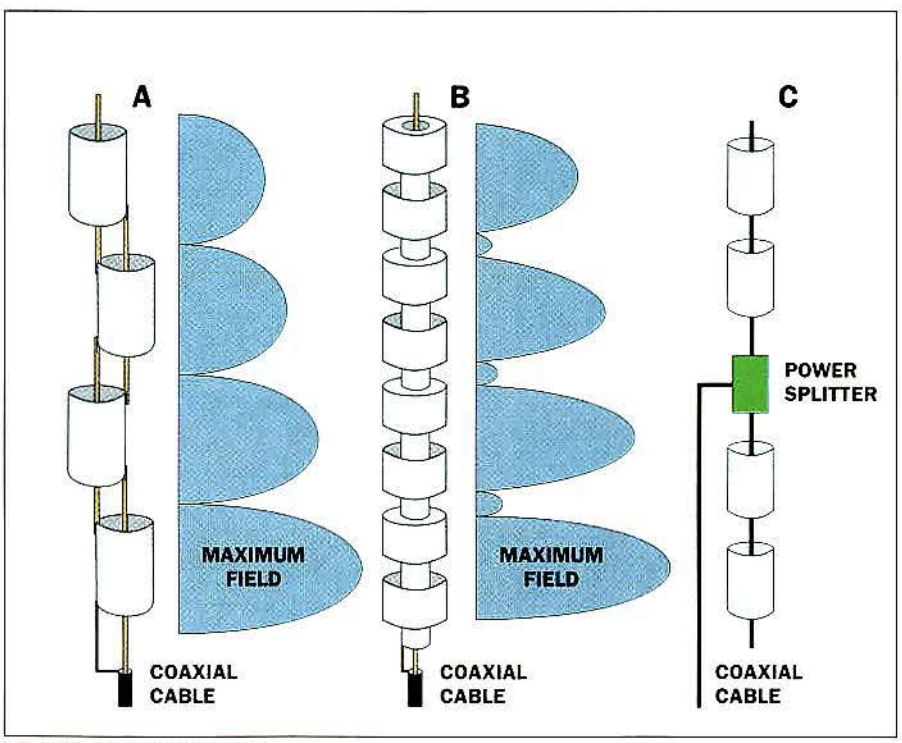


Figure 2. Series-type feeds.

Simon is the owner of Mountain States Marketing, a manufacturers' representative specializing in RF system and remote site design. Email: *donsimon@frii.com.*

Daniel is the owner of the Jack Daniel Company, a manufacturers' representative firm with extensive RF system design and integration activity. He is a fellow of the Radio Club of America and a member of *MRT's* editorial advisory board. He can be contacted through his company's Web site, *www.rfsolutions.com.*

land mobile

Now available with SmarTrunk II™

Icom Leads the Way

PRIVACY

Transcrypt scrambling is now available on most Icom F-series radio models.

TRANSCRYPT INTERNATIONAL

Transcrypt has modified their renowned scramblers specifically for Icom. The result: great audio in a highly secure conversation.

12.5/25 kHz CHANNEL SPACING

Icom's IC-F3VHF/IC-F4UHF F-series radios (above, in hand) support either 12.5 or 25 kHz FM channel spacing.

Most of Icom's F-series radios are multi-mode radios: multi-mode radios support 12.5 AND 25 kHz widths in the same radio. Program individual channels to operate either 12.5 or 25 kHz. It's like getting two radios for the price of one!

• Advanced PC Programming

Icom F-series radios can quickly be configured for simple or advanced use. Easily PC program a huge variety of settings, even by individual channel.

• The Latest Features & Technology

The right tool for the right job! Intrinsically safe radios meeting Mil Spec C, D & E ratings. 2-tone/5-tone capability radios with 9600 baud data ready operation. Simple, secure 2-way radios with a minimum of controls. Your dealer can configure the correct Icom radio for nearly any situation.

• Rugged, Die-Cast Construction

All Icom F-series radios feature a one-piece, die cast aluminum chassis for durability, signal clarity & efficient heat dissipation. Polycarbonate cases, too.

• Talented Service & Support Staff

Full time technical support by phone.

• Great Value!

Icom is the Leader in Price Performance

Compare! Icom offers the best in performance and features... for less.

See us at APCO Booth 1912.

©1998 ICOM America, Inc. 2380 116th Ave NE, Bellevue, WA 98004 • 425-454-8155. The ICOM logo is a registered trademark of ICOM, Inc. Transcrypt is a registered trademark of Transcrypt International, Inc. SmarTrunk II is a registered trademark of SmarTrunk Systems, Inc. WIRE1297Y

Call today for free brochures

425-450-6088

ICOM LAND MOBILE

http://www.icomamerica.com

Circle (26) on Fast Fact Card

predictable results. The new antenna uses internal feed lines protected from the elements by a radome instead of coaxial cable harnesses.

Series-fed arrays

The most common stacked vertical arrays are "series-fed" as shown in Figures 2A and 2B on page 34. Transmit power is coupled to each dipole in sequence. This approach eliminates internal cabling. However, as the power is divided down, each dipole is less effective than the preceding one.

To improve the E-Plane (vertical) pattern in a series-fed antenna, elements must be added to produce gain equivalent to that of a corporate-fed design. Adding elements increases the overall length, which magnifies wind, vibration and ice loading effects. Mechanical stability is difficult to maintain, and a shortened life is common. Longer arrays suffer increased tip deflection, which translates into more frequent "pattern deflection" problems.

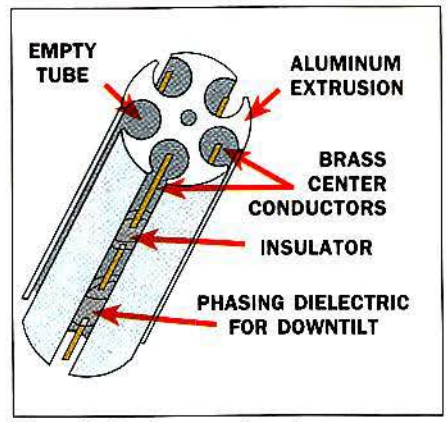


Figure 3. Mast perspective view.

The physics of coupling relationships makes building series-fed antennas with more than 15MHz of bandwidth difficult. This translates into more feed lines, antennas and site leases than we might like.

Pattern scanning

"Pattern scanning" is another problem for services with 45MHz transmit-to-receive splits in the 800MHz and 900MHz bands. Most series-fed antennas are designed for minimum "return loss" (VSWR) at the transmit frequency. However, this means the phase relationships at the receive frequency are not right. As a result, operating below the center frequency causes pattern *down-tilt*, while operating above the center frequency causes *up-tilt*. All of this leads to some interesting unbalance issues between the antenna performance on uplink vs. downlink.

Users have found at least one novel approach to reduce the effect of pattern scanning by feeding a splitter located in the center of the antenna and then series-feeding the elements above and below the splitter, as shown in Figure 2C. This allows the two halves of the antenna to act against each other to reduce scanning, but this may make the beamwidth of the antenna vary across the band.

Truly vertical antenna mounting, mechanical stability (*i.e.*, tip deflection) and tower deflection become critical when scanning is combined with narrow beamwidths.

Pattern deflection

Popular high-gain, series-fed antennas have narrow beamwidth (typically ±3.5° at zero downtilt). The combined effects of wind, ice, tip deflection, tower sway and mounting errors can lift the pattern off the ground, causing call drops during high wind. Pattern scanning just makes it worse.

Gain antennas reduce the beamwidth of an antenna, and the main power lobe can become quite small. For example, one well-known 9dB gain antenna has a ±3dB beamwidth of 8°, meaning that the main beam power will be concentrated ±3.5° above and below the horizon, assuming the standard 0° downtilt version. If the tip of the antenna is deflected from a true vertical position by 3.5°, the signal will drop in two directions (the direction of the tilt and its opposite direction) by 3dB.

The combined effects of high winds, ice loading, tower sway and mounting error all contribute to this problem. The problem is compounded when the scanning effect of older antenna designs is included.

The new antenna design minimizes this

Now you can have the convenience of a belt clip & protection of a BEE® Case

New from BEE®

Clip-on Cases

Available in

Leather or Durus® Nylon

If you love the convenience of a belt clip on your portable, but hate the way plastic always seems to break... BEE® has a solution for you!

Introducing the first belt clip available on a top quality leather or nylon case. Our clip is formed from heavy gauge, heat treated, powder coated spring steel and is securely riveted to the back of the case. You'll never have to worry about radio damage again.

GIVE US A BUZZ 1-800-336-3115

Now your choice of three convenient ways to carry your radio case:

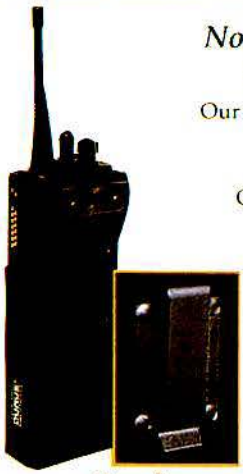
Our new spring steel belt clip mounted on the back of either leather or Durus® cases.

or

Our famous quick disconnect swivel option.

or

Regular snap down belt flap.



Durus®

BEE® PRODUCT DURUS® MADE IN THE U.S.A.

BEE®

2120 Roberts Drive, Broadview, IL 60153
Tel: (800) 336-3115 • Fax: (800) 345-2091
E-Mail: beecase@aol.com

Leather

BEE® and Durus® are registered trademarks of BEE Electronics, Inc.

Circle (27) on Fast Fact Card

When Every Second Counts, Rely On Orbacom's TDM-150 CRT-Based Console System For Your Critical Emergency Communications Needs

Shown Above: The Lancaster County, Pennsylvania, 911 Communications Center With Orbacom's TDM-150 CRT-Based Console System.

Easy-To-Use Primary Operating Screen. Resembles Traditional Radio Channel Modules; Control Modules, As Well As Other Displays, Can Be Adjusted To Meet Your Unique Dispatch Operation Conditions.

ORBACOM

As an established leader in the industry, with decades of experience in the design and manufacture of sophisticated communications consoles, Orbacom is the name to trust for your community's critical emergency call and response situations. Orbacom's new generation of TDM-150 Communications Control Consoles is not only state-of-the-art, but also sets the stage for efficiently expediting your immediate emergency communications needs, as well as effectively fulfilling your ever-expanding future response requirements. Some outstanding features of Orbacom's TDM-150 include Multi-Level Trunking Interfaces, On-Line Screen Changes, "Drag & Drop" Instant Screen Creation, Multi-Function Screen Grid, On-Screen Alarm Notifications, Windows™ Applications and many more user-friendly operations. The ultimate bottom line is that you and your community will appreciate knowing that when it comes to protecting life and property, you can depend on Orbacom's technology to help you transmit vital instructions, *when every second counts*. For more information, please call or fax in your request for free literature: 609-829-4455/fax:609-829-6980.

Circle (41) on Fast Fact Card

9-1-1

ORBACOM SYSTEMS, INC.

1704 Taylors Lane, Cinnaminson NJ 08077 Tel: 609-829-4455 Fax: 609-829-6980

Windows is a registered trademark of Microsoft, Inc.

problem. The antenna tip deflection is only 0.5° in a whopping 225mph wind, *and* the beamwidth is increased to 10°. The massive internal mast extrusion, short length (9.5 feet total for 8dB gain) and the 0.22-inch-thick fiberglass radome serve to make the antenna strong and rigid.

Corporate feed system

Figure 3 on page 36 illustrates the new method of implementing corporate feed in the antenna. The center mast of the antenna has five precisely extruded and machined tubes extending the full length. When a brass center conductor of the proper diameter is centered in these tubes, they become perfect air dielectric coaxial lines.

The clever use of low-loss air dielectric transmission lines matches the phasing characteristics of the broadband dipole elements, so there is an inherent mechanical match between the components. This makes the transmission line length equal to the dipole feed points. If ordinary coaxial cables were used, the propagation rates would be different, and mechanically matching the lengths would be nearly impossible.

Downtilt

Even the manner in which the antenna achieves downtilt is different. The designer placed a predetermined length of dielectric around the feed transmission line to the dipole, as shown in Figure 3. This changes the propagation of the transmission line, and therefore the phasing, between the dipoles. The length, not the position, of the dielectric insert determines the amount of downtilt. Existing antenna designs are for 3° and 5°. Other angles should be easy to produce.

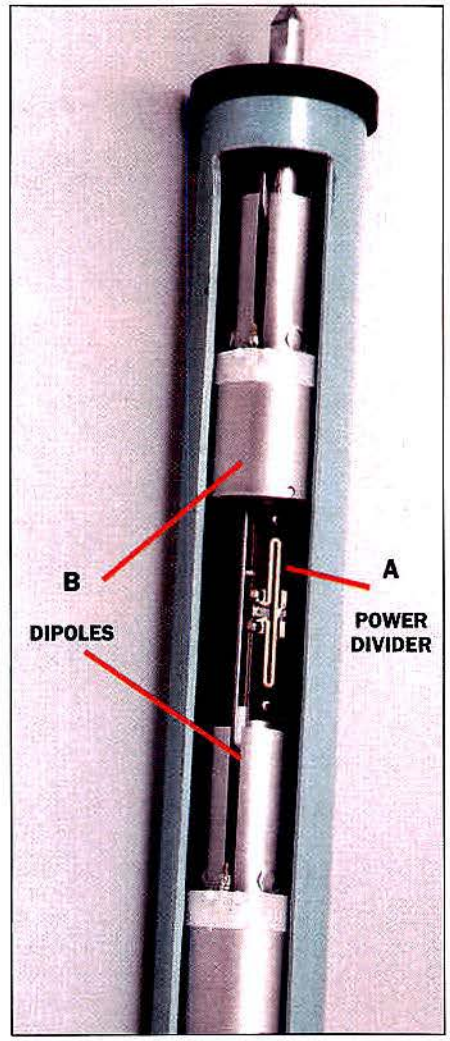


Photo 1. Cutaway view of the antenna.

The extruded mast also provides most of the mechanical strength and stability, extending the full length of the antenna. This huge cross-section is an excellent low-resistance ground for the antenna. Lightning-induced failures should be rare.

Bandwidth improvements

The bandwidth of an antenna is primarily determined by frequency-sensitive coupling components and the diameter-to-frequency ratio of the dipoles. True coaxial mounting allows the dipoles in the new antenna to be many times larger than most early antenna designs, contributing to the record bandwidth. The use of air-line coupling virtually eliminates frequency sensitivity.

Reactive "T" power dividers required in the new antenna are constructed as shown in Photo 1, note A, at the left. The power dividers are of a broadband stripline design with low loss. The power divider is gold-plated to eliminate corrosion and intermodulation.

The dipoles shown in Photo 1 are arc-welded at all points for maximum mechanical strength and to eliminate any intermodulation due to corroded or broken joints, loose screws or any of the other common intermodulation sources. There are no metal screws connecting any conducting circuit in the antenna.

Power handling

The antenna is capable of handling 1,000W continuous input, allowing use with large SMR and paging combiners.

Mechanical considerations

Based on prior antenna construction and improved testing methods using antenna network analyzers, many system operators now assign an arbitrary antenna life of 18–24 months.

Most series-fed antennas derive their strength and wind/vibration resistance from the radome. The internal parts take a beating as the radome flexes and vibrates in the wind. The small internal joints fail from work-hardening of the materials, there is dissimilar metal corrosion, and jumpers are blown by high lightning currents.

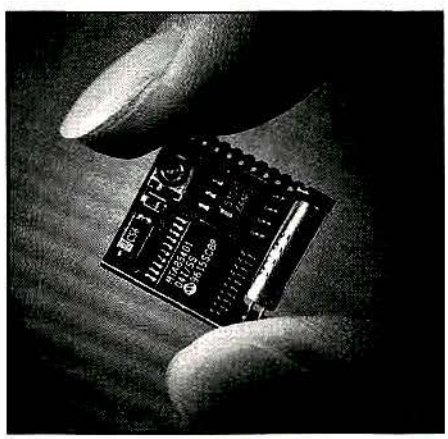
Applications

The new antenna is suited for rural cellular and SMR applications. Matching uplink and downlink patterns that assure hand-held coverage and fill will be consistent, with fewer dropped calls and reorders. The wide vertical beamwidth of the antenna will prevent pattern lifting and call drops during wind storms. The pattern will stay on the ground with the mobiles.

Paging operators will be able to combine operations at 902MHz, 929MHz–931MHz and 940MHz. Additional dual-antenna models are forthcoming in various combinations to reduce site rental costs.

Site operators will find the 806MHz–960MHz bandwidth of the antenna useful on master receiver multicoupler systems. ■

Digital ANI: Compatible with Motorola® MDC-1200®



Micro-Miniature ID-12

Manufactured by Control Signal®, the ID-12 ANI encoder is a cost-effective way to upgrade all the radios in your fleet with ANI that is compatible with Motorola MDC-1200. Works in all radios, and its tiny size (.59" x .65" x .12") allows it to fit in virtually all hand-helds. Has leading and trailing IDs, emergency, and time-out timer. Fleet price (100 qty) $89 ea.

Call 800-521-2203

CSC | CONTROL SIGNAL

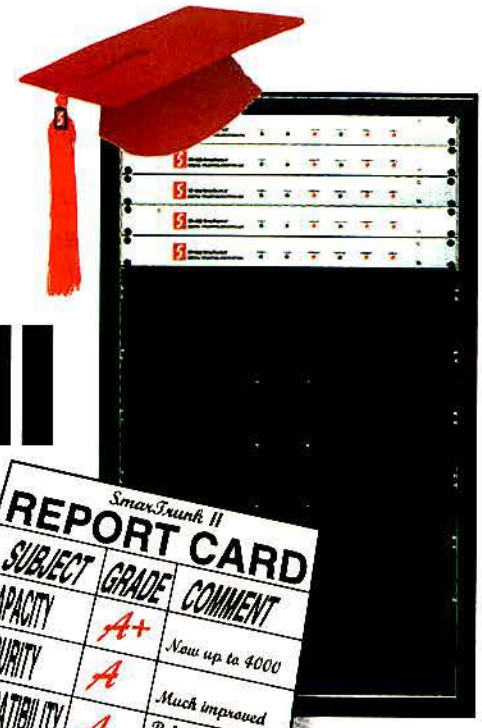
1985 S. Depew, #7, Denver, CO 80227
(303) 989-8000 FAX 303-989-8003

Motorola and MDC-1200 are registered trademarks of Motorola Inc.

Circle (42) on Fast Fact Card

An Even Smarter SmarTrunk II

Head of the Class with A Great Future

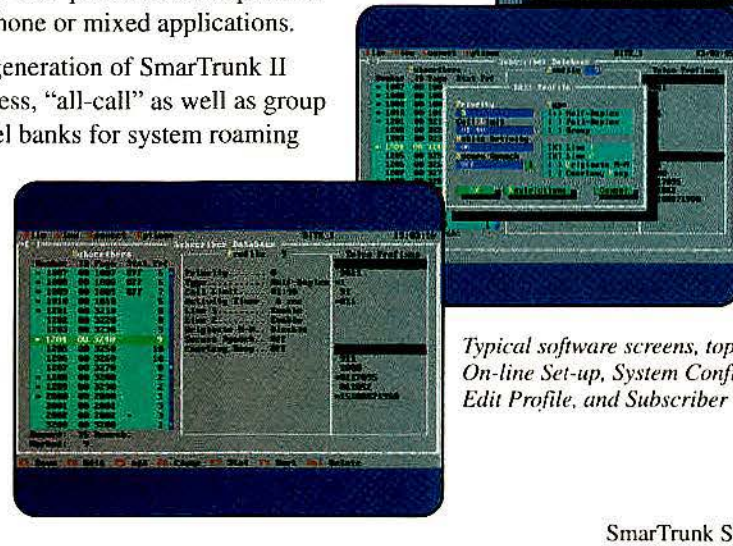


Many astonishing improvements in our new ST-853 Enhanced Digital Trunking Controller have made SmarTrunk II easier to program, more secure, higher capacity… in short, a smarter system. Designed for larger single-site trunking systems, **the new ST-853 is fully compatible with your existing SmarTrunk II mobile logic boards**. What's more, the new ST-853 offers improved operation for dispatch applications at a fraction of the cost of other trunking systems.

For the system operator, the new ST-853's expanded memory can accommodate up to 4,000 subscribers and 4,500 call accounting records with even greater system security. A built-in serial bus linking all channels at a site provides one-step system programming and improved channel management. New programmable subscriber profiles provide a greater selection of user parameters to optimize your system for dispatch, radiotelephone or mixed applications.

For the radio subscriber, a new generation of SmarTrunk II logic boards offer faster channel access, "all-call" as well as group and individual calls, multiple channel banks for system roaming capability, and improved functionality for radios without keypads.

All the more reasons why SmarTrunk II, with over 3,000 systems in use worldwide, will stay at the head of the class into the next century.



Typical software screens, top to bottom: On-line Set-up, System Configuration, Edit Profile, and Subscriber Data Base.

PHONE US NOW FOR FULL FACTS

SmarTrunk Systems, Inc.

COMMITTED TO QUALITY ISO 9001 REGISTERED FIRM

SmarTrunk Systems, Inc.
23278 Bernhardt Street
Hayward, CA, USA 94545-1621
Phone (510) 887-1950 • Fax (510) 887-4011
Email: salesinfo@smartrunk.com
Web Site: http://www.smartrunk.com

Circle (43) on Fast Fact Card

Time is tissue

While the wireless voice and data technologies supporting EMS improve, research assesses use of wireless networks to trigger response at the moment of collision.

By the MRT Staff

"Time is tissue" is a battle cry in the emergency medical services (EMS) community. Forced by definition to be reactive, EMS providers constantly seek ways wireless communications can reduce their response time.

Current advances include more efficient and useful radio communications and telemetry. Meanwhile, activity in Congress, supported by the EMS community, foreshadows a vast expansion of wireless systems to instantly notify ambulance and rescue units of automobile accidents.

En route preparation for the emergency scene is being enhanced by real-time messaging via wireless mobile information software. For example, the Packetcluster Rescue system from Cerulean Technology, Marlborough, MA, designed for fire and rescue response, has features applicable for EMS and for agencies with dual duties. Once an agency's computer-aided dispatch (CAD) or records management system (RMS) is tied into the server, responders can access details about the emergency scene from their vehicle. In addition to route displays, responders can view hazmat databases and identify any individuals at the site who have special requirements or medical conditions.

Coordination of shared communications among different ambulance providers is also a critical area. Several ambulance companies in Lansing, MI, using Motorola MTR2000 radios, had difficulty using an area hospital's repeater because the radios would not accommodate multiple use of the Private Line feature. State Electronics, Lansing, and Zetron, Redmond, WA, worked together to create a new interface assembly combined with a tone panel that allows the multiple PLs.

Several companies are also working to refine dispatch for EMS applications. American TriTech, San Diego, has developed the Windows NT-based VisiCAD for Ambulance system to give dispatchers data access and control, with redundancy, in a multitasking client/server system. EMS providers can customize the system for their operation and dispatch using point-and-click procedures.

On-site biomedical telemetry continues to improve as well. Racom Products, Cleveland, has produced a cellular-based, full-duplex system to allow remote simultaneous transmission of voice and electrocardiogram (ECG) data to the base hospital from an accident or rescue site. The 3W Life-Tel system operates portably on lead-acid batteries.

Testimony before the U.S. House Telecommunications subcommittee this spring indicated the need for ubiquitous nationwide wireless networks to support wireless E9-1-1 calls. The committee's chairman, Rep. Billy Tauzin (R-LA), has introduced H.R. 3844, the "Wireless Communications and Public Safety Enhancement Act of 1998," which, among other things, calls for extensive development of automatic collision notification (ACN) technology to speed EMS and rescue response time.

"We heard of the importance of getting help to a victim of a car crash in the first 60 minutes—the 'golden hour,' and how speeding emergency services to the site can save lives," Tauzin said in June.

Section 6 of the bill proposes a funded R&D program, administered by the National Highway Traffic Safety Administration (NHTSA), for a comprehensive ACN system that transmits information about a crash to emergency personnel by a wireless telephone in the vehicle. The research would also develop a uniform wireless telephone interface for motor vehicles to permit transmission of crash data and voice-activated, hands-free use of all models of wireless telephones.

Jeffrey Michael, chief of the Emergency Medical Services Division of NHSTA, testified that the legislative agenda is in line with his agency's EMS agenda.

"NHTSA currently conducts crash research with trauma centers and trauma and EMS systems nationwide. ... In addition, our Crash Injury and Research Network currently provides NHTSA with a test bed for many of this section's goals. The agency's ACN deployment program in Erie County, NY,—the only complete ACN system—has experienced six crashes. In all cases, the system has worked effectively," Michael said.

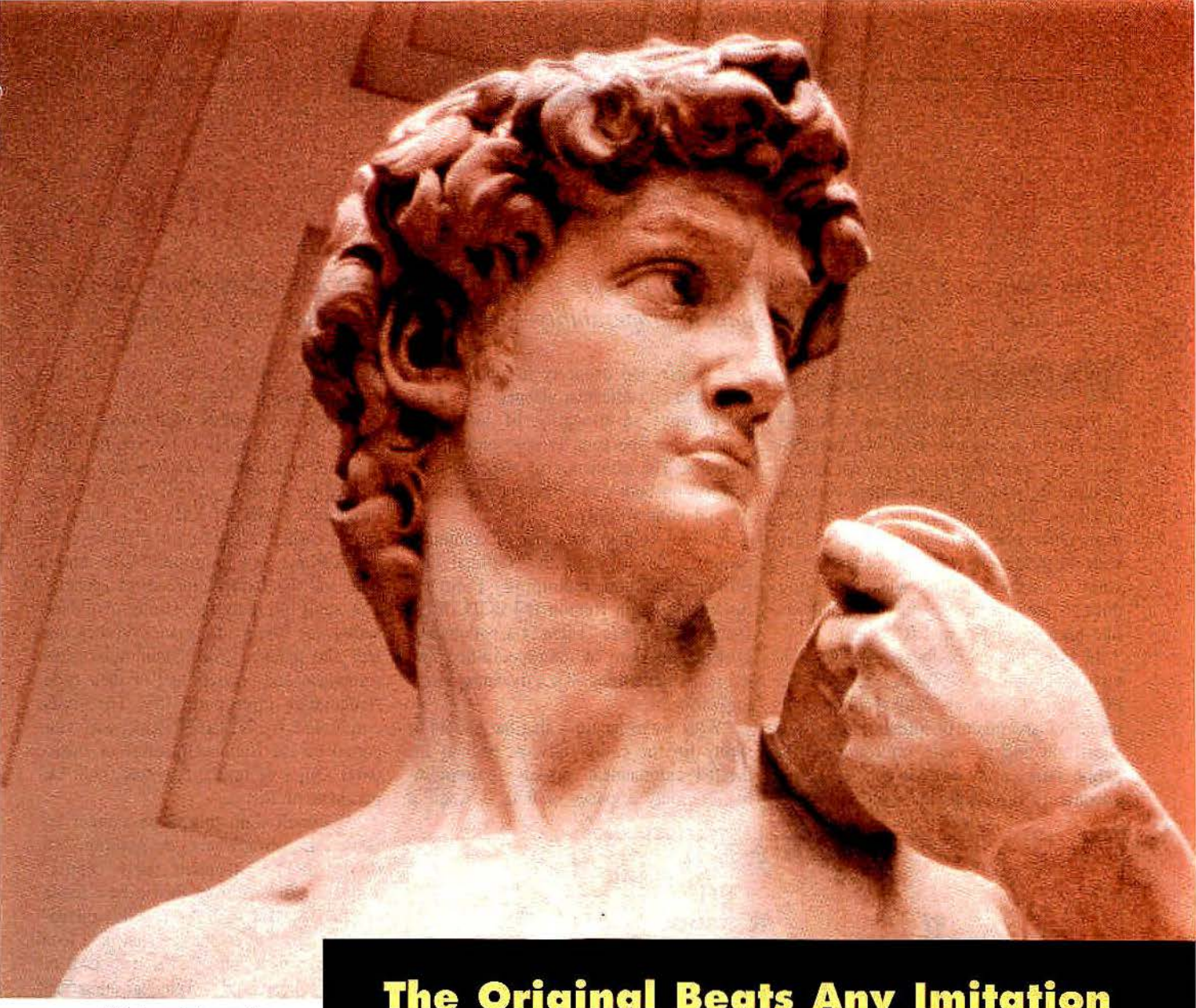
David K. Aylward, executive director of the ComCARE Alliance, Washington, DC, a coalition of more than 20 EMS professional, public safety and wireless industry organizations, discussed one crash during the Erie County tests in May.

"A young man drove off a highway into a ravine. His car was part of a test funded by the DOT that put automatic crash notification technology in his car. Before he could get out of the car, the dispatcher was asking him over his car phone what condition he was in. Before he could limp back to the highway, emergency personnel were there to help him," Alyward said.

John Melcher, director of information systems for the Greater Harris Co. 9-1-1 Emergency Network, Houston, also testified in support of ACN.

"Networks must be configured to accept automatic crash notification information and other live data. ... This may sound like a developmental project of NASA proportions, but it is, simply, a matter of using existing tools in a collective and coordinated fashion. Integrating voice and data via digital networks is nothing dramatically new.

"The example [Congress sets] will forge the relationships necessary to integrate wireless service providers, trauma care specialists and 9-1-1 professionals," Melcher said. ■



Michelangelo Buonarotti:
David

The Original Beats Any Imitation

The inventor's know-how and more than 40 years of experience in RF technology make every single SUHNER lightning protector an unsurpassed original.

- SUHNER – the specialist for lightning protection in wireless communications
- Outstanding RF and passive intermodulation performance
- Products IM-tested, with certificate on request
- Maximum protection and reliability
- Products capable of handling the powerful "direct strike" test pulse of 10/350 µs
- Very flexible in meeting our customers' technical and delivery requirements

Choose the Reliability and Safety of the Original!
The SUHNER – the better!

HUBER+SUHNER

HUBER+SUHNER AG
Wireless Division
CH-9100 Herisau
Phone +41 (0)71 353 41 11
Fax +41 (0)71 353 47 51
www.hubersuhner.com

Circle (44) on Fast Fact Card

In pursuit of interoperability

Data gathered by the Justice Department provide a snapshot of where law enforcement agencies are now with communications interoperability—and where they think they're going.

By D.A. Keckler

Interoperability standards, the protocols that permit a common interface between different communication systems, are a high-profile issue in public safety communications. The capability for law enforcement officers to coordinate their activities with other agencies (and to maintain constant communication while passing through other radio systems in situations like high-speed pursuit) is critical.

In 1996, the Public Safety Wireless Advisory Committee (PSWAC) advised the FCC and NTIA that "Unless immediate measures are taken to alleviate spectrum shortfalls and promote interoperability, public safety agencies will not be able to adequately discharge their obligation to protect life and property in a safe, efficient, and cost-effective manner." The FCC did approve an allocation of 24MHz in January, but spectrum is only part of the equation. The efficiency of radio systems depends on both radio frequency availability and compatibility.

As Tom Tolman, manager of communications technology for the National Law Enforcement and Technology Center—Rocky Mountain Region (NLECTC-RM), Denver, told *MRT*, "There is a nationwide, growing problem of interoperability, and it's not a static thing, it's a dynamic, growing problem.

"What we're facing is that the margin of safety for the community, as well as for the law enforcement officials, is diminishing. It's only a matter of time ... where a loss of life will be directly attributed to interoperability," Tolman said.

Tolman is co-author (with Mary Taylor, senior research analyst, Denver Research Institute, University of Denver and Robert C. Epper, deputy director, Technology Programs, NLECTC-RM) of a study released earlier this year on wireless communications and interoperability among state and local law enforcement agencies. The study presents the results of a 1997 nationwide survey of agencies on their current and planned use of communications equipment and services and of their experience with interoperability. The study, conducted by NLECTC-RM, was supported by the National Institute of Justice (NIJ), Office of Justice Programs, U.S. Department of Justice.

"We don't want this to be another bureaucratic, go-nowhere, do-nothing, 'oh, that's nice,' sit-on-the-shelf report," Tolman said. "We want this to be a living, breathing, active tool that can be utilized."

NIJ's projects emphasize state and local agencies, which cannot fund their own research, Tolman said. "We're an intercessor or advocate for state and local agencies."

Questionnaires were mailed to all U.S. agencies with more than 100 sworn officers and to a stratified random sample of smaller agencies across the country. More than 1,300 agencies responded, which, with telephone followup, produced a response rate of nearly 50%—a particularly large response.

Key findings of the study were:

❑ Interoperability is common, with 82% of agencies having at least one channel dedicated solely for use with other organizations. (See Figure 1 at the left.) Although most agencies are confident of their ability to handle routine situations, many experience serious obstacles, particularly when trying to communicate with agencies beyond their local network or

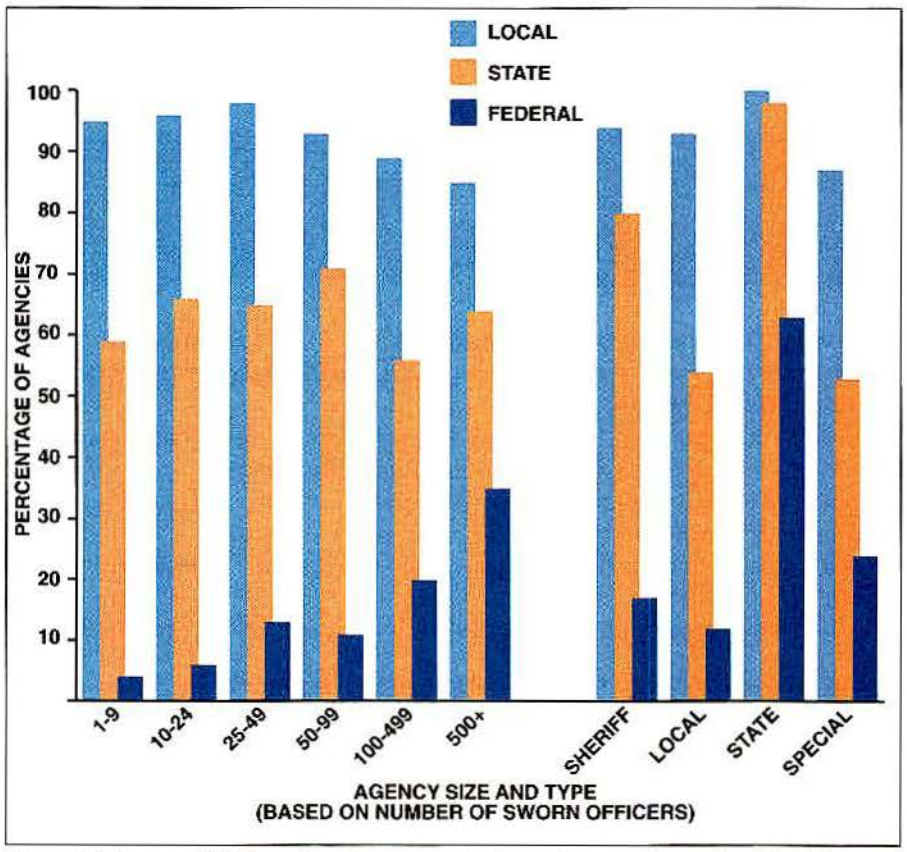


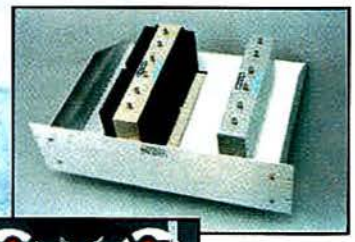
Figure 1. Interoperability is extremely common for law enforcement agencies of all sizes and types, with 93% of agencies that responded to the survey indicating that they interoperate on a daily or weekly basis with local organizations. Interoperation with state agencies occurs among 63%, but only 15% interoperate with federal agencies daily or weekly.

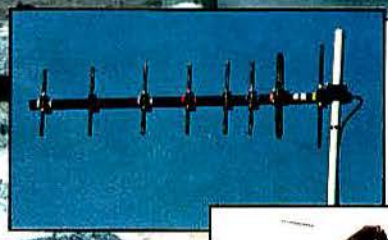
Keckler is features editor.

The full NLECTC report is available online through the Justice Information Web site, *www.ncjrs.org*.

"COMING THROUGH LOUD AND CLEAR"

- Wattmeters
- Combiners
- Duplexers
- Antennas
- Filters
- System Integration





Telewave, Inc. delivers high performance everytime, everywhere.

We bring 26 years of product and system design experience to the table for every customer, large or small, worldwide.

With a full line of standard products, and custom designs available for special projects, our support of Public Safety, Government, and Business systems is second to none.

Contact Telewave today at **1-800-331-3396** and discuss your system requirements with our sales engineers. Or visit our website at **www.telewave.com**

Telewave, Inc.
1155 Terra Bella Avenue
Mountain View, CA 94043
email: sales@telewave.com

TELEWAVE, INC.™
Wireless Communications Manufacturers Since 1972

Circle (45) on Fast Fact Card

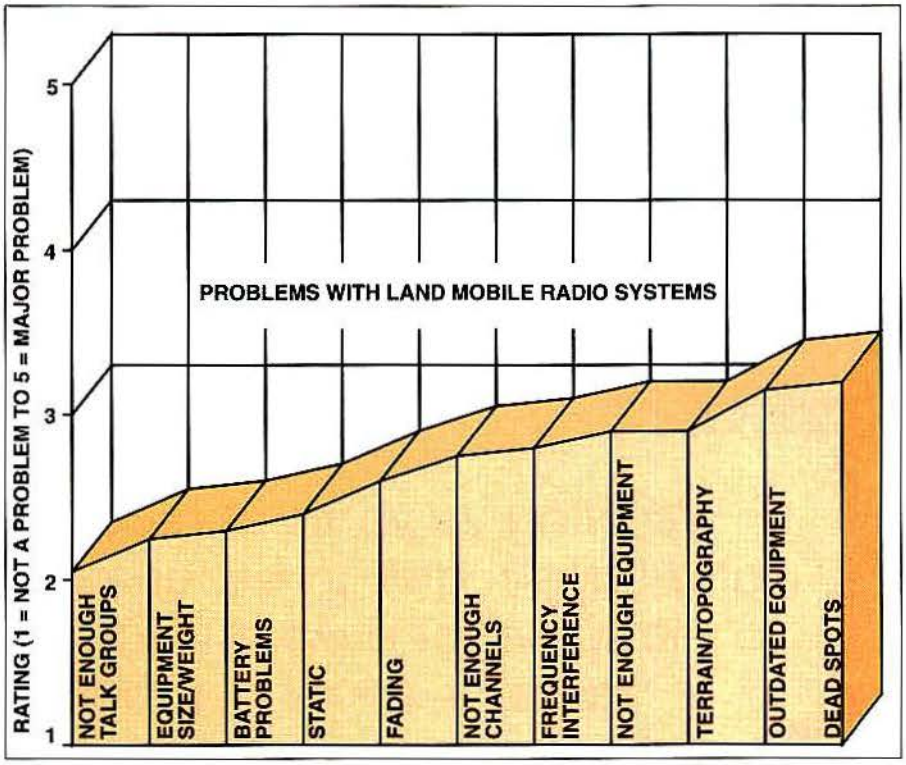


Figure 2. Law enforcement agencies surveyed identified dead spots and outdated equipment as the most common and serious problems with their radio systems. All the above technical problems compete with interoperability for radio system funding.

operating in different frequency bands.

❑ Limitations in funding and frequency incompatibility were identified as the biggest interoperability problems.

❑ Thirty-five percent think state or federal mandates are needed to ensure interoperability, but the majority believe local planning best meets their needs. Many agencies indicated that funding assistance would make mandates more acceptable.

❑ Discrepancies in state and local perceptions about the existence of formal state interoperability plans suggest a need for more dialogue between state and local law enforcement agencies.

❑ Most agencies have conventional analog systems and operate in high VHF bands, but information from agencies planning to replace or upgrade their systems within 10 years (46% percent of the total) indicated that the number of agencies operating at 800MHz will about double, as will those using digital systems. The use of trunked systems is also expected to increase.

❑ Most radio spectrum is used for voice transmissions, but the number of agencies devoting channels to data-only transmissions is increasing. Plans for use of new technologies and mobile or portable computers will increase the need for additional spectrum. The use of laptops (projected to double in the next 10 years) is currently replacing mobile data terminals in larger agencies.

If you depend on your batteries, here are a few things we think you should know...

1 Our unique battery processing and reconditioning systems are widely recognized as the very best available. Even the US Military says so, and who's going to argue with them? From the ground up, our system designs are superior in many ways. Simply put, it means we offer you more capabilities, more reliability, for more battery types, with a better, simpler interface than any other system - period. For example, we offer intelligent, ***truly simultaneous processing*** of up to ***252 batteries*** faster than others process 4!

2 Our technological leadership is thanks in part to our ability to provide custom-designed solutions when customer needs exceed existing industry capabilities. That's how we pioneered the only true reconditioning charger. That's also how we created the only true Smart Battery Processing System. We've been leading the industry since 1986; so don't let the other guys mislead you. As they announce their "industry firsts", we want you to know that they've never even come close to catching up.

3 Our customers report that after using our reconditioning systems, many of their batteries are actually in better shape after 3 years of use than they were new out of the box! This is why our systems often pay for themselves in less than a year. Most people just don't believe it until they see it, so call us today to see how you can benefit from ***The BatteryPRO Advantage.***

▲ 28 pack RAMSystem

YEAR 2000 Compliant!

BATTERY PRO
the life support system for ALL your batteries.

When the performance of your batteries can mean the difference between life and death, why would you settle for anything less than the very best?

http://www.batterypro.com

BatteryPRO Systems Inc., 203 - 1 Ave. N.W., Black Diamond, AB, Canada. T0L 0H0. Toll-free: 1-800-661-9401, Ph: 403-933-5393. Fx: 403-933-3233, Email: sales@batterypro.com

Circle (46) on Fast Fact Card

HARRIS

THE SMART CHOICE FOR NATIONAL LAW ENFORCEMENT /// THE SMART CHOICE

National and international law enforcement agencies have more information at stake than can be secured with just any encryption.

That's why smart agencies choose Harris.

Harris provides law enforcement solutions with Type 1 encryption, DES and our own Citadel encryption technology – and has already been chosen by numerous national security agencies to secure top secret information.

When you need to be secure in the knowledge that your radio transmission is safe from sophisticated interception, you'll want to consider the Harris Seneca™ Communications Platform.

Seneca provides secure communications for agencies with the highest level of security requirements including:

- National security agencies
- Federal civil agencies
- Military law enforcement
- International police agencies

Seneca's control microphone has a state-of-the-art design that remotely controls multiple radios, data and imaging devices from the palm of your hand.

Harris. The smart choice for smart people like you. Call today. (800) 4HARRIS ext.3518

Circle (28) on Fast Fact Card

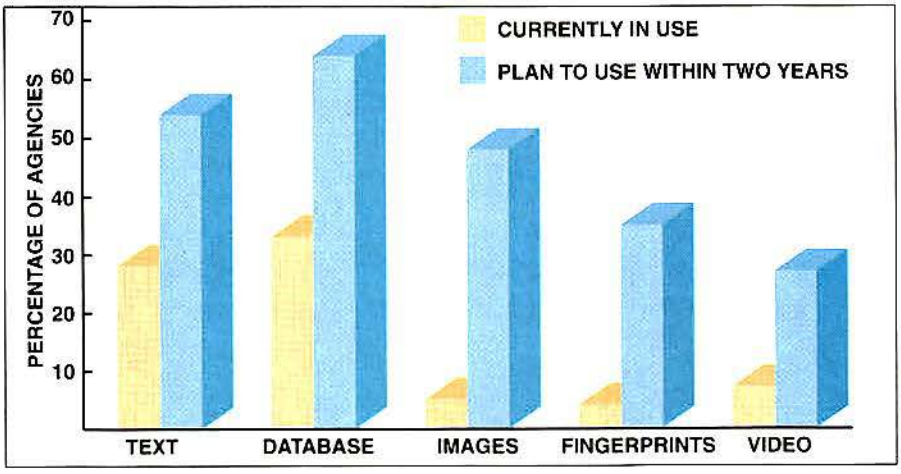


Figure 3. Current and planned use of wireless data transmissions.

WHY KEEP REPEATING YOURSELF?

Two-way communication in high noise environments is difficult and possibly hazardous. Now you can communicate clearly and protect your hearing in high noise areas with a simple communication system from David Clark. Just add our Noise Attenuating Headsets and Radio Adapter Cords to enhance the performance of your two-way radios. Our high quality headsets feature rugged construction and a certified Noise Reduction Rating (NRR) of 24 dB. They're available in Over-The-Head or Behind-The-Head styles for use with safety caps and helmets. Boom mounted or throat microphones enable hands-free performance. Choose Voice-Activated (VOX) or Push-To-Talk (PTT) systems with adapter cords for over 300 two-way radios. For clear two-way communication in high noise, there's only one name worth repeating — David Clark.

For more information and a FREE demonstration, call toll-free:

1-800-900-3434

David Clark COMPANY INCORPORATED

360 Franklin Street, Box 15054, Worcester, MA 01615-0054 U.S.A.
TEL: (508)751-5800 E-Mail: sales@davidclark.com FAX: (508)753-5827
Visit our web site at www.davidclark.com

U.S.A. Quality

©1997 David Clark Company Inc. - Green headset domes are a David Clark Company Trademark. T-5

Circle (29) on Fast Fact Card

❑ Dead spots and outdated equipment are the most common problems with radio systems. (See Figure 2 on page 44.) More than half of the agencies that complained of outdated equipment (older than 10 years) had plans to replace or upgrade their radio systems.

❑ Channel congestion, a serious problem for almost half the agencies, is much less of a problem for agencies with trunked systems. Large and state agencies indicated the greatest need and requested the greatest number of additional channels.

❑ The use of voice and data security measures is increasing in all agencies. Large and state agencies currently are the most likely to use security measures.

Wireless data

Tolman pointed out that the report demonstrates "a growing demand for spectrum in other areas, such as data." Text, imaging, video, database use and fingerprint transmission are all expected to increase over the next two years, as shown in Figure 3 above.

More than 90% of respondents have channels dedicated to voice-only transmissions, 27% have some channels dedicated to data-only and 19% use alternate voice and data channels. The need for additional data-only channels shows the greatest rate of increase, even though the greatest overall need is for more voice-only channels, the report found. The number of law enforcement agencies that will be using electronic text for reports and queries, and database information, on MDTs and laptops will double in the next two years.

Familiarity with standards

Larger agencies were found to be more familiar than smaller ones with interoperability initiatives such as the FCC frequency application process, Project 25 interoperability standards (as shown in Figure 4 on page 48) and National Public Safety Planning Advisory Committee (NPSPAC) guidelines.

About 70% of respondents said interoperability issues and standards were important to the purchase of their next land mobile radio system. About a third of respondents indicated they were very likely to adopt Project 25 interoperability standards for their next land mobile radio system, another third were somewhat likely, and 19% were very unlikely. The likelihood of adopting Project 25 standards was not dependent on agency familiarity with the standards, the report found.

Tolman agreed that there are many reasons for smaller agencies being "out of the loop" regarding standards. Inexperience among communications managers, time demands in a small department and

Sample of LT-4900 STANDARD FEATURES

- CSI BASE, an application for your PC that gives you complete local/remote programming control of your system, shows usage graphs and allows remote site monitoring.
- Built-in validator will validate up to 5000 user Id's. Will also validate other controllers on the same system that require external validation.
- Separate airtime accumulators for regular time and prime time per user Id.
- Front panel LCD display shows User Id, Repeater status, error messages, built in test and more.
- Removable Front Panel gives quick/easy access to all adjustments without removing the rack or interrupting service.
- Separate E/E and DID/E&M lines are built in
- Compandor
- Universal overdial code
- Speed dialer
- Push to connect for selected user Id's
- Two built-in RS-232 ports
- Remote or Local Programming by PC
- Can share channel with conventional repeaters
- Fully LTR® compatible
- Warranty: One year service, five year parts

OPTIONS

- Voice prompts (user recordable)
- Call detail records
- Built-in Modem (only one needed per system)
- MF Signalling
- Networking

LTR® trunking on UHF

Move over Pseudo-Trunking. Low cost **LTR®** controllers from **CSI** and new turnkey UHF **LTR®** radios (more to come soon plus **LTR®** conversions for many brands) have just made **LTR®** the new trunking standard on UHF!

Real LTR® Trunking gives you the features and performance formerly only available on 800/900 systems, PLUS eliminates the expense and hassle of installing scan trunk boards in user radios.

Unique CSI Overlay allows conventional repeaters to double as **LTR®** Trunking channels. Simply add an LT-4200 to each repeater. This allows you to phase in **LTR®** Trunking without adding repeaters or disrupting your conventional service.

Call Ray Dashner today for the complete story on **CSI** UHF/800/900 **LTR®** Controllers, CTCSS/DCS Tone Panels, Interconnects and more.

Model LT-4900 for LTR® Dispatch / Interconnect channels.
$1499 dealer net.

Model LT-4200 for LTR® Dispatch channels. $649 dealer net.

NEW Data Logger Option for LT-4200
4200L extends the LT-4200 time/hits logging to include all 5000 ID's. This allows the LT-4200 to log data from other brands of **LTR®** controllers on the same system.

Toll Free	(800) 545-1349
Phone	(805) 642-7184
FAX	(805) 642-7271
e-mail	sales@connectsystems.com
www	http://www.connectsystems.com
In Canada	Cartel 800-663-0070

Circle (25) on Fast Fact Card

Connect Systems Inc.
2259 Portola Rd.
Ventura, CA. 93003

LTR is a registered trademark of E.F. Johnson Co. CSI is a registered trademark of Connect Systems Inc.

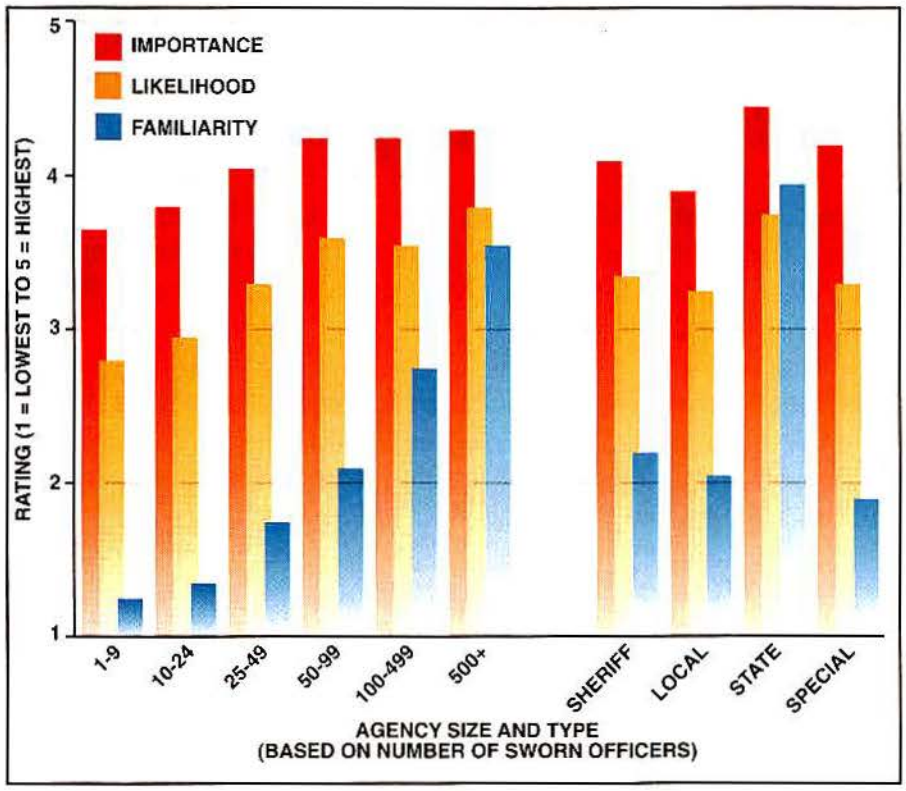


Figure 4. Comparisons of importance ratings of interoperability standards, the likelihood of adopting Project 25 standards and agency familiarity with Project 25 standards. Of all respondents, 70% deemed interoperability standards to be a consideration for their next system purchase. The least familiarity with the standards occurs in small, local agencies.

small budgets are all factors, he said. About 75% of the roughly 19,000 U.S. law enforcement agencies have fewer than 25 sworn officers, so familiarity with communications standards may be wanting.

Funding for interoperability

The sense of competition for funding is acute among agencies. All agencies surveyed rated "limitations in funding" and "different bands" as the two biggest obstacles to interoperability, as shown in Figure 5 on page 49. Overall, 69% percent of respondents rated limitations in funding as a severe problem. Agencies that rated funding limits as a serious problem also rated both their radio system's ability and their agency's ability to handle different types of interoperability situations significantly lower than did agencies satisfied with their funding

"This is one of the primary drivers toward regionalization," Tolman said. "Jurisdictions are realizing it's in their best interest to combine communications centers and simply pool their resources." *(See "Blue Ridge ..." News, page 65.)* The real choice may be whether to get three new patrol cars, hire two new employees or upgrade the radios, he said.

"This interoperability study has accom-

Andrew stops lightning before it stops your system

Arresting Developments

Andrew never stops developing innovative lightning protection solutions. Arrestor Plus® Surge Arrestors are offered in quarter wave stub or gas tube technologies in a wide range of configurations to satisfy your system requirements.

1. Integrated Series Surge Arrestors – easier, cost saving attachment directly to HELIAX® cable with innovative RingFlare™ Connector technology.
2. T-Series Surge Arrestors – bulkhead or stud mounting/grounding options for your specific application.
3. Mini Series Surge Arrestors – quick installation for small radio cabinets and tower mounted amplifiers.
4. Gas Tube Series Surge Arrestors – for broadband performance, simple maintenance; ideal solution for applications requiring DC feed through coax.

For superior lightning protection, call Andrew or your local Andrew Distributor today.

1-800-255-1479 ext. 362
or fax us at 1-800-349-5444
Visit our Web Site at
http://www.andrew.com

ANDREW®

In A Communicating World, Andrew Is Everywhere

Circle (31) on Fast Fact Card

plished a lot of the things that we wanted to, it's gained a lot of favorable publicity, and it's being utilized around the country by smaller agencies," Tolman said.

In June, at the urging of Associate Attorney General Raymond C. Fisher, work began on a "short, high-end" videotape presentation of the study targeted for audiences such as the National League of Cities, the National Governors Association and state legislators.

The success of the law enforcement survey has also prompted urging from the FCC to identify the communications needs of fire and EMS agencies. NLECTC is currently working with the Public Safety Wireless Network to develop that study, which should be completed this fall, Tolman said. The study will be logistically more difficult because of the larger number of fire and EMS agencies, compared to law enforcement, and the volunteer nature of many local departments, which makes it difficult to reach them.

Although many studies look for the "big discovery," Tolman said the NLECTC report really provides validation for what many believed to be true about law enforcement communications, but could not quantify.

"This study is a collective voice," Tolman said. "The agencies spoke." ■

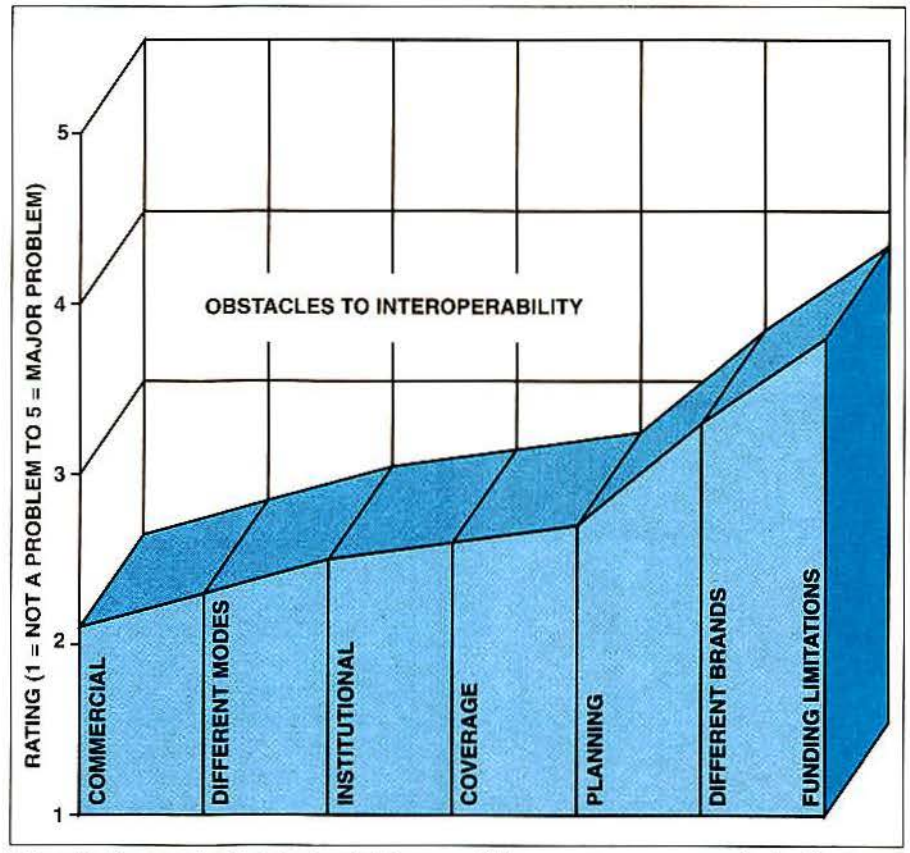


Figure 5. The perceived obstacles to interoperability among survey respondents. The top of the hill for most agencies is limitations in funding.

KEEP TRACK OF YOUR WORLD.
Preserve Conversations with...

...OMNICRON Professional Voice Logging Recorders. Automatically record your important phone conversations, two-way radio messages, conferences and meetings – under $500.00 per channel

- Voice activated recording
- 2, 8, or 16 hours of solid talk time on a standard audio cassette
- Talking clock repeats time and date on optional time track
- Alarms monitor tape movement to prevent operator error
- Instant review of messages • Full line of accessories

omnicron
OMNICRON ELECTRONICS
581 Liberty Highway
Putnam, CT 06260
860•928•0377
FAX: 860•928•6477
www.omnicronelectronics.com

Circle (32) on Fast Fact Card

Your Source For Portable Accessories

PRYME
Radio Products

Mini Boom Microphones
Remote Speaker Microphones
Surveillance Microphones
NiCad and NiMH Battery Packs for most portables

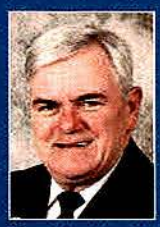
Many models available!

Dealer Inquiries Welcome
Call 1-800-666-2654
PRYME Radio Products by PREMIER Communications
See our webpage at www.pryme.com

Circle (64) on Fast Fact Card

APCO International, the Association of Public-Safety Communications Officials, presents the 64th APCO Conference and Exposition. It will take place Aug. 9–13, 1998 in Albuquerque, NM. APCO is the world's oldest and largest not-for-profit professional organization dedicated to the enhancement of public safety communications.

APCO Officers



President
Joe McNeil

President Elect
Jack Keating

First
Vice President
Joe Hanna

Second
Vice President
Lyle Gallagher

Glen Nash will be elected as second vice president of APCO at this year's conference. He is running, uncontested, following Barry Furey's withdrawal from the campaign. Nash has been involved in public safety communications for 25 years, 14 of those as a supervisor. He has been a member of APCO for 11 years, and has served two one-year terms as president of the Northern California Chapter for APCO and six other years on various chapter offices.

"I think my active involvement at both the local and association levels of APCO speaks well to my ability to provide sound leadership and to my dedication in serving APCO," Nash said.

Conference Highlights

Conference Seminars

Conference seminars will cover several major topics such as innovative technologies, management and planning strategies, telecommunication training and interaction, 9-1-1 practices and procedures, and ADA (Americans with Disabilities Act) compliance.

Session titles include: Responding to the Deaf Community; Loving Evaluations; Mayday Plus; Ergonomics of Mobile Computing; 3-1-1 Update; APCO ADA Committee Roundtable; Hazardous Materials Emergencies: Are You Ready?; Stress Awareness and Management; Justice in Self Evaluations and Audits; Attitudes and Atmosphere; The Funeral of Diana, Princess of Wales; Debugging Your Dispatch.

Please consult the Conference Pocket Guide in the registration packet at the show for the final agenda and presentation schedule.

General Information

APCO Pavilion

APCO will sponsor a pavilion in the exhibit hall again this year. If you have questions or would like more information on APCO International, please stop by the pavilion and talk to staff from APCO headquarters.

MANAPCO Night

The Albuquerque Civic Plaza will be the site of the exhibitor-sponsored 1998 MANAPCO event. The Civic Plaza is located directly behind the convention center. MANAPCO Night will be a native American experience for all fully-registered attendees. There will be Indian music and dancers, a balloon glow, Mariachi bands and a popular local band playing 60s, 70s and 80s music. Merchants from the Albuquerque area will display jewelry and pottery for sale.

The event will feature New Mexico foods such as guacamole salad and tri-colored chips, tortillas, tamales, enchiladas, fajitas, burritos, barracho beans and Spanish rice, Mexican pastries and much more. Non-hosted bars will include beer, wine, Margaritas and sodas.

Shuttle buses will provide transportation to and from the Plaza. The shuttle schedule will be provided in the program guide.

Audio Tapes

Conference sessions will be audiotaped. Only those presenters who have given their consent will have their seminars taped. Audio tapes of the seminars and sessions may be purchased. Order forms will be available at the registration area of the convention center.

Special Activities

All those participating in special activities programs will depart from the convention center, east wing, south side.

Keynote Speakers:

Commissioner Gloria Tristani of the FCC

Tristani has served on the FCC since November 1997. Before that, she served on the New Mexico State Corporation Commission, where she was the first woman elected to that office. She has served on the National Association of Regulatory Utility Commission's communications committee. In 1996, she was named one of the nation's 100 most influential Hispanics by *Hispanic Business* magazine. She received her undergraduate degree from Bernard College of Columbia University and her law degree from the University of New Mexico School of Law.

She will address the opening luncheon.

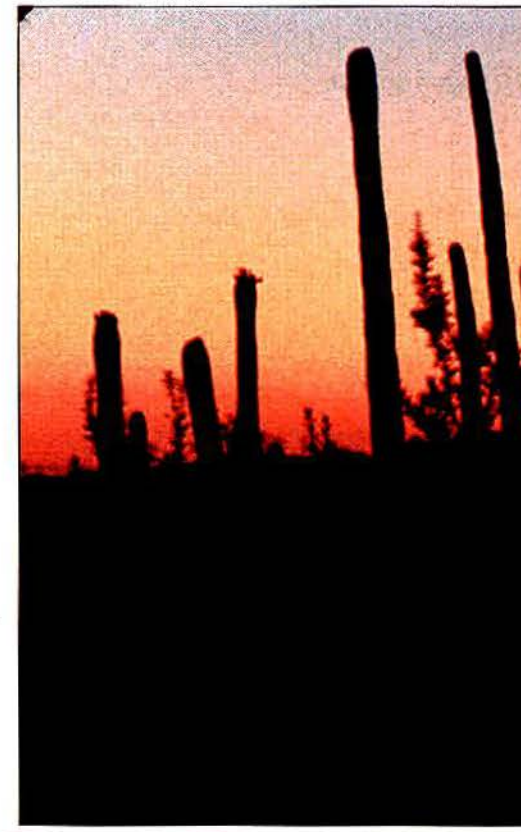
Sam Silverstein

Silverstein will present "You are the Star," a motivational session. He teaches that success has always been within our grasp if we would only accept responsibility for it. He will present five elements for all successful endeavors and direct applications for balancing both professional and personal goals. Silverstein teaches personal and professional empowerment and helps organizations internationally become more effective in managing change and learning leadership skills.

Michael Fortino

Fortino will present "Preparing for 2000." His program will focus on the idea that in order to be successful in the workplace, people need to keep up in this technological era. He will give suggestions on learning and managing the change in the information age.

Fortino is the president and founder of the Center for Lifestyle Management with offices in Pittsburgh and San Francisco. He is a renowned speaker, particularly recognized for his dynamic, motivational and humorous presentations.



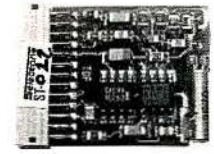
Here's a Family that Keeps its Secrets

Introducing Selectone's Full Line of Voice Encryption Products

Today more than ever, the world of two-way communications needs the advantage of secure voice. The Selectone family of voice encryption products offers you **a clear choice at affordable prices.**

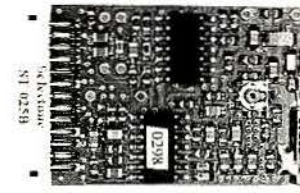
From the low-end inversion scramblers, the **ST-22** and **ST-20B**; to our mid-range scramblers, the **ST-25B** with digital rolling code security; to the state-of-the-art **Advantage-Plus** encryption series with time domain scrambling and digital signal processing, Selectone will provide the right product match for your specific security requirements. ***No hassles. No overselling. No kidding!***

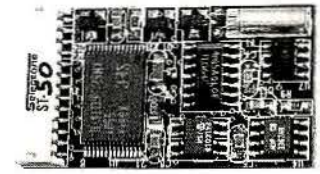
We're confident that our product line is exactly what you're looking for, and we'll provide you with a personalized quote to prove it. Simply give us a call, send us a fax or write to us with your requirements, and **we'll provide you with a customized quote at no cost.** It's simple. It's free. And best of all, it introduces you to the finest family of encryption products in the world. You have our name on it.



Low-end inversion scramblers. ST-22, ST-20B

Mid-range scramblers. ST-25B





State-of-the-Art Advantage-Plus series. ST-50, ST-51, ST-52

Selectone

CUSTOM QUOTES AVAILABLE

1-800-227-0376

Selectone, Inc. • 3501 Breakwater Ave. • Hayward, CA 94545 USA
Phone: 510-781-0376 • Fax: 510-781-5454 • Internet: www.selectone.com

Circle (34) on Fast Fact Card

Conference Agenda

Monday, August 10

7 a.m. – 6 p.m.	Registration Open
8:30 a.m. – 10 a.m.	Regulatory Panel
10:30 a.m. – Noon	First Special Open Session (Sam Silverstein)
Noon – 2 p.m.	Opening Luncheon/Keynote Address
1:30 p.m. – 4 p.m.	Special Activity Tour (registered participants only)
2:30 p.m. – 4 p.m.	First General Business Session
4 p.m. – 5:30 p.m.	APCO National Plan Committee
5:30 p.m. – 6 p.m.	APCO Meets with other coordinators
8:30 p.m. – Midnight	Route 66 Party (bring your jeans and poodle skirts)

Tuesday, August 11

7 a.m. – 6 p.m.	Registration Open
8 a.m. – 9 a.m.	Concurrent Sessions
10:15 a.m.	Grand Opening of Exhibits
10:30 a.m. – 5:15 p.m.	Exhibits Open
10:30 a.m. – 1:30 p.m.	Exclusive Exhibit Hours
1:45 p.m. – 2:45 p.m.	Concurrent Sessions
3 p.m. – 4 p.m.	Concurrent Sessions

Wednesday, August 12

7 a.m. – 5 p.m.	Registration Open
8 a.m. – 9 a.m.	Concurrent Sessions
9 a.m. – 5 p.m.	Special Activities Tour (registered participants only)

Thursday, August 13

10 a.m. – 5 p.m.	Exhibits Open
10:30 a.m. – 1:30 p.m.	Exclusive Exhibit Hours
Noon – 2 p.m.	Past Presidents/Life Member Luncheon
Noon – 2 p.m.	Frequency Advisor Luncheon
Noon – 2 p.m.	Chapter Presidents/Secretaries Luncheon
1:45 p.m. – 2:45 p.m.	Concurrent Sessions
3 p.m. – 4 p.m.	Concurrent Sessions

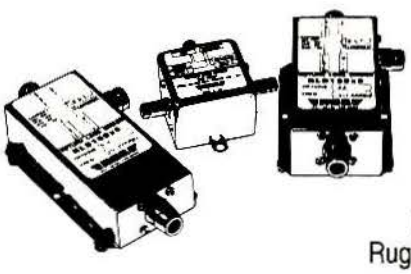
Friday, August 14

7 a.m. – 1 p.m.	Registration Open
8 a.m. – 9 a.m.	Concurrent Sessions
8:30 a.m. – 4 p.m.	Corporate Advisory Committee
9:15 a.m. – 10:15 a.m.	Concurrent Sessions
10:30 a.m. – 11:30 a.m.	Concurrent Sessions
11 a.m. – 4 p.m.	Special Activity Tour (registered participants only)
1 p.m. – 2 p.m.	Concurrent Sessions
2:30 p.m. – 4 p.m.	Special Session II (Michael Fortino)
6:30 p.m. – 7:30 p.m.	Closing Reception
7:30 p.m. – 9:30 p.m.	Closing Banquet
10 p.m.	Enchanted Evening

Saturday, August 15

9 a.m. – 2 p.m.	Special Activities Tour (registered participants only)
9 a.m. – 3 p.m.	APCO Golf Tournament
10 a.m. – 11:30 a.m.	Post Conference Meeting
4 p.m.	Board of Officers Meeting

VSWR BRIDGES & TEST CABLES

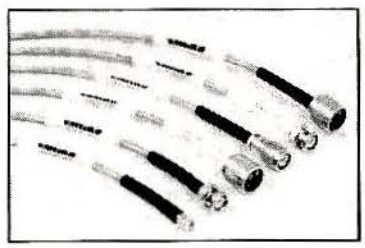


FEATURES:
5 watt power
High directivity
RF reflected port
Rugged construction

Using the EAGLE return loss bridge allows frequency domain reflectometry tests to be made easily and inexpensively. There is no need to spend thousands of dollars on a dedicated antenna tester. Simply use the EAGLE bridge with your present spectrum analyzer and tracking generator. This technique is described in our free application note. See offer below.

Price: $469.00 for a 1.0 GHz bridge.

FEATURES:
Low loss
Low Cost
Custom labels
Swept to 3.0 GHz
Rugged! 60 lb. pull
Excellent return loss



Are you frustrated with cable assemblies that break easily, are lossy at low microwave, or work intermittantly? Our bridge customers had the same problem. At EAGLE we now manufacture low-cost rugged test cables! Each one is tested on a vector network analyzer to 3.0 GHz. Our custom labeling makes cable ID a snap. Excellent return loss reduces disturbances to combiners and filters.

Price: $29.00 1-4 quantity with "N" connectors.

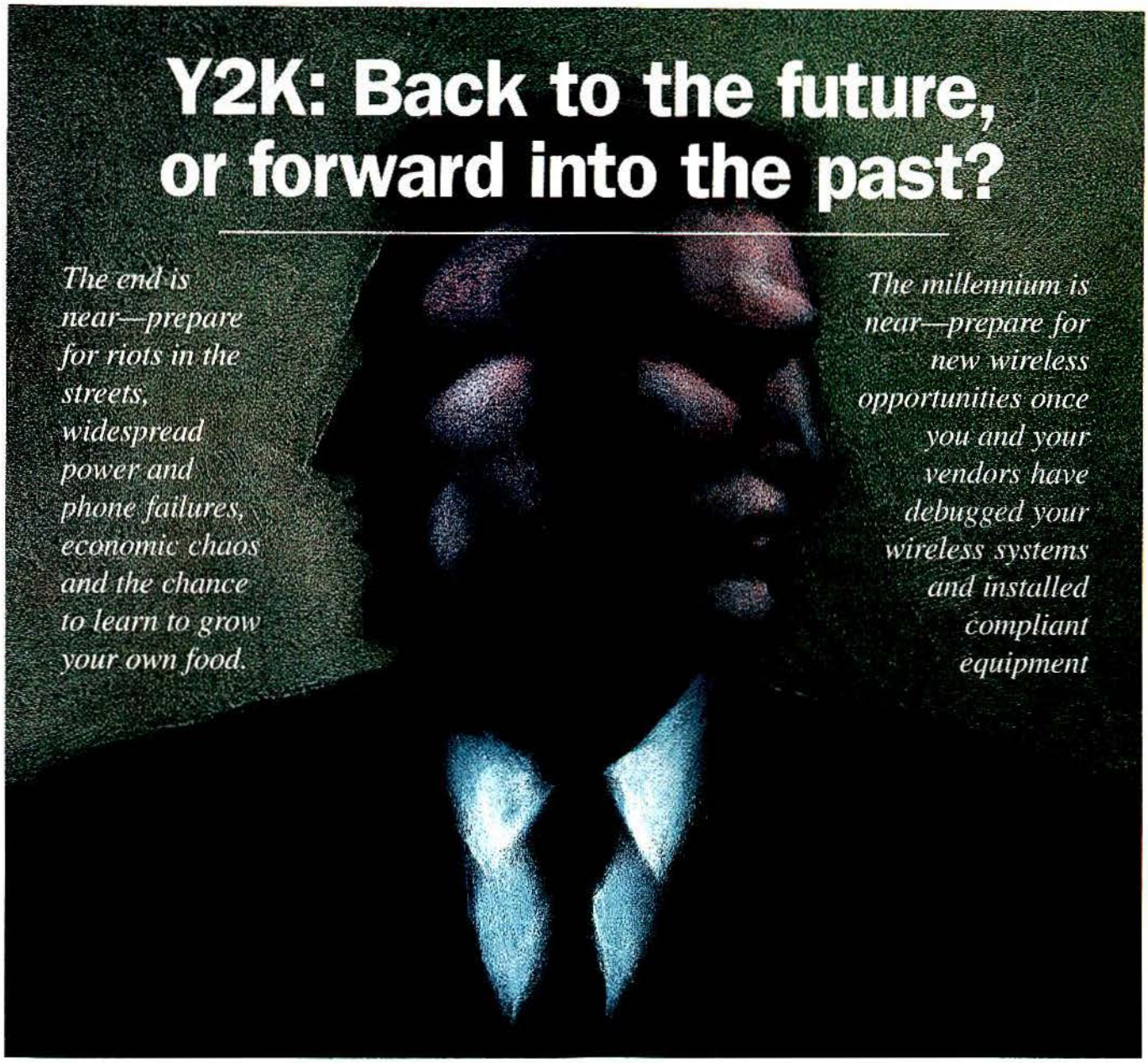
Call for FREE application note: "Antenna and Feedline Measurements"

EAGLE

P.O. BOX 4010 ♦ SEDONA, AZ ♦ 86340 ♦ VOICE: (520) 204-2597 ♦ FAX: (520) 204-2568

Circle (35) on Fast Fact Card

Y2K: Back to the future, or forward into the past?



By Emily Reid

The "Year 2000 Problem" (Y2K) is haunting every business in the world, from the smallest mom-and-pop restaurant, to the largest multinational investment banking firm. Everyone has the same problem, the same solutions to pick from—and the same deadline. That includes the mobile communications industry. There are 16 months left to fix the largest problem in the history of computer science.

Back in the 1950s and '60s, when computer programming was a developing concept, and no one realized how dependent the entire world would become on computers, Y2K was born. Programmers decided that to save memory storage, which then was extremely expensive, they would store dates as two numbers instead of four. Thus "1958" became "58." Most programmers realized that this system would not work for years after 1999 because every January 1, the computer takes the old year and adds one to it to get the new year. For example, 97+1 = 98. However, 99+1 does not equal 00, and 00−1 does not equal 99. That is the problem. Who would have thought that simple, first-grade math could have such serious implications?

At the time programmers originally designed this code, most of them assumed that their programs would become obsolete long before 2000. Unfortunately, that is not the case. This problem has been described as the greatest challenge ever to face information system managers. Fixing the old software would require today's programmers to go line by line through millions of lines of code to correct the date calculation. The options are: either figure out a way to fix it, or buy all new equipment and software. The latter is not feasible for most smaller businesses, and fixing it is not all that cheap, either. Experts predict the overall cost of solving Y2K to be between $300 and $600 billion (all of which is known as "ugly money" by agencies with fixed budgets.) This estimate does not include the costs of lawsuits that will undoubtedly arise, which could as much as

Reid is editorial assistant.

double the cost.

Y2K could lead to such serious complications as widespread power outages and banking failures. There are serious consequences for the mobile communications industry as well. Wireless phone systems could fail just at the time when they are needed most. Many people will depend on their cellular or PCS phones should landline phones go down Jan. 1, 2000. Although this is an important issue, many experts feel that public safety and its supporting industries are the most important group affected by the Y2K problem. What happens when we call 9-1-1, and no one answers? What if no one can call the police? Crime could run rampant in the streets—there would be no control.

Many police departments across the country are already prepared for the coming of 2000. The Houston police department began its efforts about three years ago. It designated several programmers to dedicate their time completely to solving Y2K. Departments in Boston and Detroit underwent similar programs and now have systems that are ready for the new millenium.

Many groups around the world are just beginning to realize the seriousness of the Y2K problem. It has taken some agencies as long as 10 years to solve their Y2K problems. Those who have not taken this problem seriously are in for a shock. The deadline

for finding a solution is absolutely immovable. As "01-01-2000" draws nearer, solutions will become more and more expensive.

Some observers even predict that Y2K will bring about the end of civilization as we know it. Already, people are considering taking all of their money out of the bank and liquidating assets in preparation. These scenarios are highly unlikely, however, because several large companies have already solved their Y2K problems, proving that it is possible. Hundreds of consulting companies are available around the world that specialize in Y2K solutions. It is just a matter of finding the right one to fit each company's needs.

Another twist in the Y2K problem is that once a solution is found that may work, there is still a huge amount of work yet to be finished. Testing is a large portion of solving Y2K. About half of the resources allocated to solve the problem will be allotted to testing. Hundreds of different components in every public and private sector network are affected by the date change, and every one must be tested thoroughly.

A key problem in solving Y2K is that we will not be 100% sure how effective the solutions are until "01-01-2000" has come and gone, and all of the different systems affected by Y2K have had a chance to work together. Many networks are codependent. For example, for someone to access his financial institution through Quicken, his computer system must be compliant, as well as the power supplier's, the bank's and the phone company's. If there is one flaw in any of these levels, the transaction will not work. Even if the systems are individually compliant, it is possible that they may not work

MDS Point-to-Point Radios for Public Safety Communications

Eliminate leased-line costs and improve reliability!

Voice and Data Radio Communications for:

- Fire, Police and Ambulance Dispatch Links
- Links to Voting Receivers and Mobile Transmitters
- PSAP Communications to Telco Central Office

CALIFORNIA MICROWAVE MICROWAVE DATA SYSTEMS

See us at APCO '98 Booth #2144

Microwave Data Systems • 175 Science Parkway
Rochester, New York 14620 U.S.A.
Phone: (716) 242-9600 FAX: (716) 242-9620
Website: www.microwavedata.com

Circle (47) on Fast Fact Card

together as they did before the date change.

Wireless equipment manufacturers are also tracking the problem. Ericsson assures on the Y2K portion of its Web site that its products "will be functional, provided that all product including software not delivered by or licensed from Ericsson must accurately exchange date data information according to the agreed interoperability test specification." Ericsson is also contributing to initiatives dealing with multivendor network interoperability testing.

What we really need is a big, worldwide dress rehearsal for the millennium change—an undertaking so big it probably could never happen. Such a rehearsal would give us a much better idea of what works and with what. Some experts say that it will take about a week to fix all of the unexpected things that go wrong to make all systems compliant with each other and the new date once "01-01-2000" arrives.

Hewlett-Packard recommends developing a Central Project Office as the best first step to take in solving a company's Y2K problems. This office ensures that the appropriate activities, resources and project plans are being deployed to minimize the exposure to risks related to Y2K. Steps taken include: assessing the situation (6% of resources), developing a strategy (20%), implementing the changes (20%), testing (40%) and redeploying applications (14%). These are basic guidelines that HP recommends all businesses follow to achieve Y2K compliance.

In a July *USA Today* article, Wall Street economist Edward Yardeni of Deutsche Bank Securities said that there is a 70% chance that Y2K will cause a recession, possibly as severe as the one in 1973–74 caused by the Arab oil embargo. He believes that it would result from investors pulling out of the stock market as they lose confidence in the ability of various companies to solve Y2K. He believes that a recession may begin as early as next year.

Companies need to understand that Y2K compliance must be a top priority. They must provide the personnel, time and resources to get the problem fixed, and soon. That is the only way that society will be able to continuing functioning the way it has been. The sooner this problem is fixed, the more confident everyone will be, and we will be able to avoid an economic crisis. The time to act is now. ■

Y2K information sites on the Web

Government

FCC: *www.fcc.gov/year2000*
GSA: *www.itpolicy.gsa.gov/mks/yr2000*

Business and industry

Motorola: *www.mot.com/General/year2000*
Ericsson: *www.ericsson.com/y2k/year2000*
Nortel: *www.nortel.com/year2000*
Lucent Technologies: *www.lucent.com/enterprise/sig/yr2000*
Hewlett-Packard *www.hp.com/year2000*
Siemens: *www.siemenscom.com/products/year2000*
3COM: *www.3com.com/products/yr2000*
www.year2000.com/y2karticles

The Right Way to Test Pagers

There's only one way to test pagers: The Right Way.

Only one company has shipped more encoders than any other for the purpose of testing pagers: **Zetron, Inc.**

We pioneered this field years ago and now bring you the most specialized encoder yet for pager testing.

Model 15T Pager Tester

- Reduced emissions do not interfere with sensitive measurements
- Shielded, metal enclosure with protective line filters
- Popular digital and analog formats
- No need to reprogram between formats
- Plug & go for fast setup
- Common analog and digital output with automatic mode switching
- RS-232 port for PC control
- Invert data on the fly
- Zetron reputation, quality, and technical support

Contact Zetron to find out why the 15T is right for you. ZETRON®

Zetron, Inc. PO Box 97004, Redmond WA 98073-9704 USA
Phone: (425) 820-6363 Fax: (425) 820-7031 Email: zetron@zetron.com Web: http://www.zetron.com
European Office: Zetron, Inc. 27-29 Campbell Court, Bramley, TADLEY, Basingstoke, RG26 5EG, UK Phone: +44 1256 880663 Fax: +44 1256 880491

Circle (48) on Fast Fact Card

Continuing EMC issues

By Harold Kinley, C.E.T.

The May "Technically Speaking" column addressed electromagnetic compatibility problems with electronic control modules (ECM) and radio communication equipment within the confines of motor vehicles. A specific problem was discussed along with test procedures to determine its severity. This column continues that discussion and highlights what has been done since that time.

The problem involved International transport trucks used to transport forestry fire-suppression "crawler" tractors. To recap, the ECM that was used to control the automatic transmission (Allison) and manufactured specifically by Motorola is causing severe degradation to the VHF high-band radio (Motorola) installed in the truck. The truck is a 1996 model International 4900 transport truck with Allison automatic transmission—World Transmission model WT2 with shift lever control.

Another larger truck, also manufactured by International, exhibited severe interference to the radio. The interference locked the scanner on a specific channel even though that channel was programmed for a CTCSS tone squelch. The noise rendered the radio virtually useless at that particular frequency. Unfortunately, that frequency is critically important for that particular truck. The inability to use that frequency places severe limitations on the usefulness of the transport truck.

It turns out that this noise problem was not caused by the automatic transmission control module, but by a module controlling the running of the engine. The engine does not have to be running for the noise to be generated. Simply turning on the ignition switch starts the noise. The ECM, manufactured by Cummins, is mounted on the engine block. Removing the fuse to this controller stopped the noise. This was a step in diagnosing the source, not in solving the problem, because the motor cannot operate with the fuse removed.

Consultation with Motorola's engineers raised the issue of just where the noise was entering the radio. Based on prior tests, it was my contention that the noise was radiated and picked up by the antenna and not conducted through the cabling. However, one of the engineers suggested placing ferrites on all cabling leading to the radio—coax line, power cable and speaker cable. This had minor results. The engineer's suggestion was to do more of this with better ferrites.

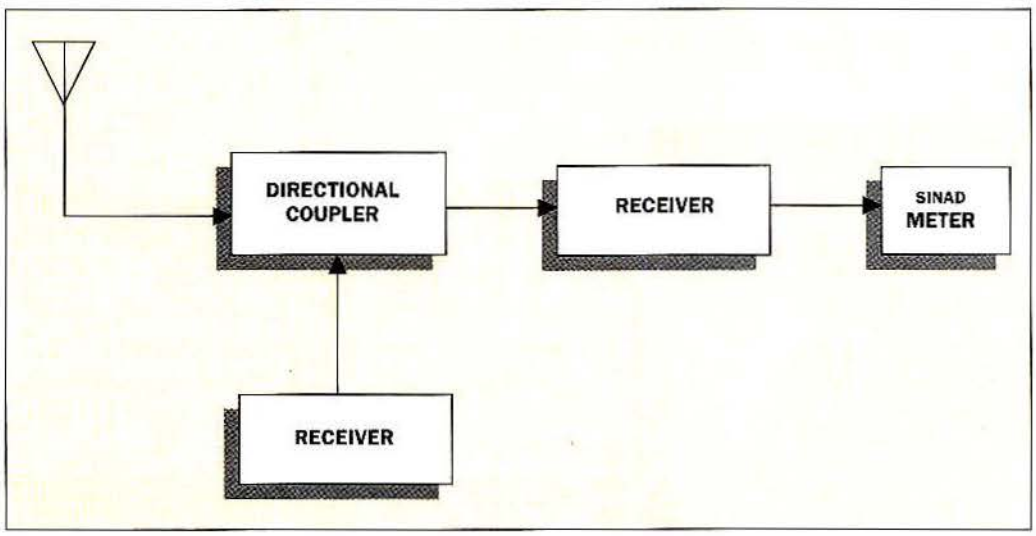


Figure 1: This test setup was originally used to determine the severity of the interference.

The engineers left, the truck was returned to its normal location—and the noise persisted. Because the truck was located in a rural area where the local RF noise should be quite low, I decided to perform more on-site tests to further pin down the source of entry of the RF noise into the receiver. Could it be entering through the cabling, or was it entering through the antenna? This issue had to be resolved. The previous test procedure that was used to determine the amount of degradation caused by the electromagnetic interference (EMI) involved the use of a directional coupler connected as shown in Figure 1 above. In the absence of the EMI, the signal generator was set to produce 12dB SINAD at the receiver output. Then, with the ignition switch on and the EMI present, the signal generator level was increased to again produce 12dB SINAD. The difference between the two signal generator levels is equal to the amount of degradation caused by the EMI.

A new "non-invasive" test procedure was devised for convenience and integrity. There was no physical change to the receiving system cabling, so the test itself did not change the situation. Also, this was more convenient because the radio was mounted within the console above the windshield, and access to the radio was difficult. To get RF coupling from the signal generator, a magnetic antenna was placed near the radio's antenna on top of the truck cab. With the magnetic antenna connected to the signal generator, the desired on-channel RF signal was coupled into the radio's antenna and at the same time, isolated from it by distance, as shown in Figure 2 on page 57.

A speaker was connected to the input of the SINAD meter and then placed close to the radio's speaker. This acoustic coupling was sufficient to drive the SINAD meter input. Double-sided adhesive foam helped to hold the coupling speaker to the radio speaker during the test procedure. Thus, the entire test setup was "non-invasive," that is, the system cabling was not disturbed at all, as shown in Figure 3 on page 58.

First, with the radio's antenna whip connected and the truck ignition switch turned off, the signal generator was set to produce 12dB SINAD and the signal generator level was recorded in dBm. Next, the ignition switch was turned on and the signal generator level was increased to produce 12dB SINAD. At one frequency, 151.400MHz, the signal generator level had to be increased by 11dB to overcome the EMI. At 159.420MHz, the signal generator

Kinley, a certified electronics technician, is regional communications manager, South Carolina Forestry Commission, Spartanburg, SC. He is a member of the Radio Club of America. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques,* which is available for direct purchase. Write to 204 Tanglewylde Drive, Spartanburg, SC 29301. Kinley's email address is *hkinley@aol.com.*

level had to be increased by 7dB to overcome the EMI. The amount of degradation is frequency-dependent.

Next, with the spring and quarterwave whip removed from the radio's antenna mount, the same test was repeated. This time there was no difference between having the ignition switch turned on and turned off. This indicated that the point of pickup for the EMI was not the cabling but the antenna whip itself. After all, the cabling was the same. The only difference was the removal of the antenna spring and whip from the radio's antenna mount. Obviously, a much greater signal level was required from the signal generator to produce 12dB SINAD with the radio's antenna spring and whip removed.

Though we have been persistent in our efforts to get the manufacturers to fix these problems, to date they remain virtually unabated. However, some reduction was achieved on certain frequencies by changing the frequency of the microprocessor crystal. Sufficient relief is yet to be obtained. Again, I will keep you posted on further actions and developments in future columns.

* * *

On the subject of vehicular EMC problems, I received a letter from H.M. "Jack" Tibbetts, senior manager of cellular systems for CellularOne in Burlington, MA.

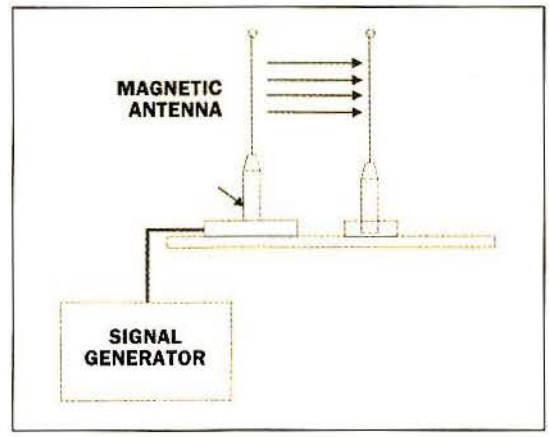


Figure 2: A magnetic antenna couples the signal from the signal generator into the receiver without the need for direct connections to the radio.

An excerpt from his letter follows.

Your article (May 1998) brought to mind similar experiences that I had. In the early years of vehicle ECUs, a customer of the service shop I was working for brought in his new Cadillac to have us install the latest GE Executive II 150MHz IMTS unit.

We installed and tested the unit, and he left happy. About a month later he came back for us to repair a small problem. We were talking during the course of the repair, and I asked him how he liked his new car. He lamented that he was having a lot of trouble with it and was tired of making repeated trips to the dealer. I inquired about the car problem, and he told me that the car would occasionally, for no apparent reason, run very roughly. The dealer was never able to find anything wrong but was on the verge of replacing the transmission under the vehicle's warranty.

The dealer had involved the Cadillac zone manager for the Boston area in this problem, and they both had agreed to the transmission replacement. At this time I had not given any thought to a radio/ECU interference problem. We continued to discuss his car problem, and I held his IMTS unit at the shop to continue the repair. I let him leave without the IMTS unit and asked him to come back the first of the week.

When he returned to pick up his radio, I asked him how the car was running. He told me that it ran all weekend OK, and that he had done a lot of driving.

During the repair of his radio, I had to refer to the service manual, and I noticed that GE had included some verbiage relative to checking out the radio in the vehicle to make sure that there was no interference with vehicle electronics. I asked him to take me for

AF CommSupply
YOUR WIRELESS WAREHOUSE
ANDREW®
Accept No Substitute
• HELIAX® Coaxial Cable
• RADIAX® Radiating Cable
• Cable Connectors
• Installation Accessories
• Jumper Assemblies
Call or fax to receive our new 1998 Catalog
800-255-6222 • FAX 800-282-3266
Circle (49) on Fast Fact Card

Interference Cancellation
Commercially Available Military Anti-Jamming Technology
Automatically Suppress Co-channel, Adjacent Channel & Broadband Interference
CMA-2032 Antenna Signal Processor
CMC
CANADIAN MARCONI COMPANY
Tel: (613) 592-7440 Email: asp@kan.marconi.ca
Fax: (613) 592-7434 Web Site: www.marconi.ca
1-888-262-2032 (1-888-CMA-2032)
"Providing innovative solutions to Interference Problems"
Circle (50) on Fast Fact Card

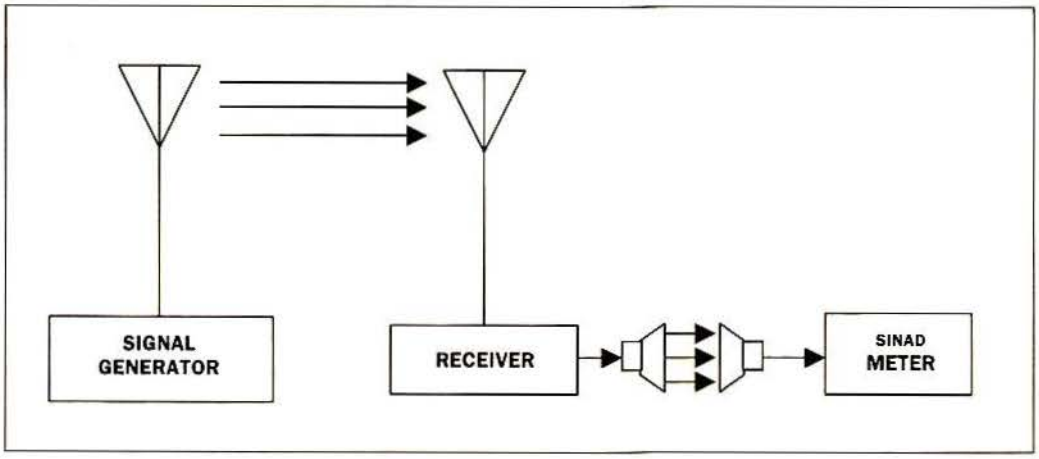


Figure 3. This coupling arrangement requires no direct connection to the intercabling between the radio, antenna or speaker. It is a non-invasive test setup.

a ride around the block while I made a test call on the phone. He agreed, and we set off with him driving and me making the phone call. As soon as the radio transmitter keyed, the car engine started to run rough, and the car kind of jerked along. I immediately terminated the call, and we returned to the shop.

He gave me the name and telephone number of the Cadillac zone manager. I put in a call to him, and we discussed the problem. After several minutes of discussion and questioning, we learned that the Cadillac engine ECU was housed in a plastic case for the first time that year. For some reason or another, GM had decided to try a plastic housing on the ECUs in their Cadillacs first. The Cadillac zone manager arranged to get a Chevrolet ECU (same unit only in a metal case) and have it installed in this customer's car. PROBLEM SOLVED! The customer was happy, and Cadillac was happy. Customer: car and phone working perfectly. Cadillac: no expensive transmission replacement.

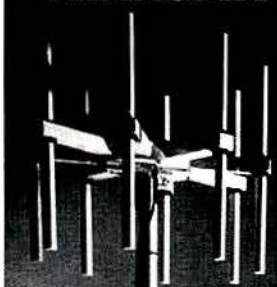
A similar incident happened with the Cadillac assigned to the president of Raytheon. He solved the problem by having his engineers wrap the ECU and its wiring in aluminum foil. His radio was a 110W VHF GE Executive II.

My worst nightmare is that the electronics in my vehicle are going to be interfered with by a radio transmitter in a vehicle next to me on the highway.

Thanks to Mr. Tibbetts for sharing this information with us. Problems such as this will get worse unless manufacturers attack this problem at *design* time. Once the RF noise gets out of the box, it is difficult to put it back. Often, simple solutions, such as the aluminum foil, just aren't sufficient to suppress the noise below the interfering threshold. Manufacturers will only take heed when customers become more discriminate or when fleet managers, when letting bids for vehicles, include specifications that deal with EMC problems where it hurts—in the wallet!

Until next time—*stay tuned!* ■

TRANSMITTER LOCATION



New fixed site direction finders provide 2 degree accuracy, and include software for triangulation from a central control site. Mobile versions also available covering 50MHz to 1 GHz

Doppler Systems Inc.
PO Box 2780 Carefree, AZ 85377
Tel: (602) 488-9755 Fax: (602) 488-1295
www.dopsys.com

European Marketing Director Denis Egan
PO Box 2, Seaton, Devon EX12 2YS England
Tel & Fax: 44 1297 62 56 90

Circle (51) on Fast Fact Card

VOCOM

UHF Trunking Amplifiers
Output Powers Available:
- 50 Watts
- 100 Watts
- 200 Watts
- 350 Watts

VOCOM PRODUCTS COMPANY, L.L.C.
800 USA MADE
847-593-1213
FAX 847-593-1320
sales@vocomrf.com
www.vocomrf.com

VISA
MasterCard

Circle (52) on Fast Fact Card

Transcrypt takes steps to overcome controversy about financial statements

Transcrypt International released its restated audited financial reports on July 15, 1998, after a four-month-long sequence of events resulting from questions about the wireless communications products manufacturer's financial condition, operations, liquidity and ongoing 1997 audit.

The reports, issued by auditor KPMG Peat Marwick, Omaha, NE, restated the revenues for 1997 and 1996 as $40.4 million, and as $10.6 million, respectively. The restated revenues for 1996 and 1997 showed a $14.5 million discrepancy from the original financial reports, according to Transcrypt's statement. The net loss for the two-year period increased by about $9.1 million.

The Lincoln, NE–based company said in a press release that it had reanalyzed its accounting policies regarding revenue recognition, which resulted in the restatement of previously reported financial results for 1996 and 1997. In other words, revenue had been recorded for products shipped but not yet paid for. The new report stated that revenue was recognized for "certain sales where a formal written agreement was not received" and for "sales of certain products which were subsequently returned to the company." The methods of recognizing the percentage of completion of the E.F. Johnson acquisition and the allocation of the purchase price of the acquisition were also cited. Transcrypt acquired E.F. Johnson, the two-way radio and system manufacturer, on July 31, 1997 for $34 million.

Craig J. Huffaker, Transcrypt's chief financial officer, said, "We have initiated tighter monitoring and control procedures to ensure strict compliance with the company's revenue recognition policies moving forward. New accounting policies have been instituted in regards to government contracts and the use of extended payment terms to customers. We are also changing the reporting relationship for our order-processing group. This area will report to finance."

KPMG issued the financial reports a little over two months after being hired by Transcrypt to replace Coopers & Lybrand as independent auditors. Coopers & Lybrand resigned on April 24 and withdrew its previously issued auditor's reports for the fiscal years 1996 and 1995.

Jim Stark, Transcrypt's director of investor relations, said, "Now we have a clean opinion from KPMG on our financials. It wasn't contingent or subject to anything, which is very good. Normally if a company has wrongdoings or fraud, per se, an accounting firm will not give you a clean opinion until the company comes out and makes a statement to that manner—that there was some fraud or something."

The controversy began in March when an anonymous letter, addressed and delivered to Coopers & Lybrand, alleged that two sales totaling $1.75 million to one government customer in 1997 were not properly recorded. On March 27, Transcrypt announced a delay in the completion of its 1997 audit because certain accounting principles relating primarily to revenue recognition had not been resolved.

Between March 31 and May 27, 12 class action lawsuits were filed against the company in the U.S. District Court in Nebraska. Some of the complaints also named one or more officers as additional defendants. The complaints allege violations of some federal securities laws and relate primarily to allegations of false and misleading financial statements and representations and material omissions by the company.

> *'Now we can go out and show them our audits and show them that we are, in fact, a viable company. I think that will go a long way.'*
>
> **— Huffaker**

"The lawsuits are starting to progress a little more quickly. There were 12 federal class-action suits filed, and I'm sure they've all been combined into one class action lawsuit. Our expectation is that we might see some movement on those within the next 60 to 90 days," Stark said. "I think if we can resolve that outstanding issue, it will help on the NASDAQ side of business, as well as with the SEC investigation."

Within three days of Coopers & Lybrand resigning, the NASDAQ National Market delisted the company's stock based on the panel's determination that the company failed to maintain current public filings with audited financial statements.

The Securities and Exchange Commission also issued a formal order of investigation to determine whether violations of federal securities laws had occurred in connection with the company. Transcrypt stated in its new financial report that it is "unable to predict whether the SEC is likely to initiate proceedings against the company or its affiliated parties relating to these events."

Stark said, "The SEC is looking at our accounting records. Any piece of information they ask for, they get. That's how we've been cooperating with them."

About a month after its stock was delisted, Jeffrey L. Fuller, Transcrypt president, and C. Eric Baumann, vice president of North American sales, resigned. John T. Connor, chairman of Transcrypt, has been acting as CEO in the interim. The board of directors appointed a committee, chaired by Director Thomas Thomsen, to conduct a nationwide search for a permanent CEO. Ed L. Osborn, the senior vice president of marketing and chief operating officer who joined the company in April, moved up to acting president.

The delay in the 1997 audited consolidated financial statements, the resignation of Coopers & Lybrand, the ongoing investigation by the SEC and the resulting uncertainty of class-action lawsuits have "negatively impacted the company's sales and customer confidence during the second quarter of 1998," according to Transcrypt's statement.

Now that the restated financial results have been released, Transcrypt is working to come out ahead in the wake of this four-month-long ordeal.

"We certainly have to go through a period of rebuilding customer confidence, now that we have our numbers and audits," Huffaker said. "The main thing is to show them our viability because a lot of questions were raised when all this occurred. There was a lot of uncertainty. And now we can go out and show them our audits and show them that we are, in fact, a viable company. I think that will go a long way."

Stark said that once the company is current with its filings with the SEC, various stock dealers can become market makers, which will probably move the stock into trading on the over-the-counter bulletin board.

Transcrypt continues to have conversations with NASDAQ regarding the timing of its relisting. Stark said that it could take several months.

"Getting this audit is actually a very positive step for our customers because there had been concern of 'would Transcrypt be around?'" Stark said. "We put in a press release what our cash balances were and where we stood with everything, so they would know that we are a viable company and we plan to be around."

Geotek directors resign; company seeks Chapter 11 bankruptcy protection

Five directors of Geotek Communications, Montvale, NJ, resigned in June, including Yaron I. Eitan, chief executive officer, and members Haynes G. Griffin, Winston J. Churchill, Walter E. Auch and Purmendu Chatterjee. William Spier will remain on the board as chairman. George Calhoun is departing his position as senior vice president of marketing, but will retain his membership on the board of directors, along with Richard T. Liebhaber and Richard Krants. Also departing is Michael McCoy, executive vice president and chief operating officer.

In papers filed with the Securities and Exchange Commission, Geotek revealed loans ranging from $100,000 to $300,000 that it provided to Eitan, McCoy and Calhoun for personal use. As of March 31, 1998, each of these loans had an outstanding balance due.

Resignations are not unusual for a company undergoing changes such as Geotek's, according to Alan Shark, president of the American Mobile Telecommunications Association (AMTA).

"People on the board who have not been successful bringing in the capital make way for people who can," he said.

Geotek has not yet selected a new chief executive officer. Both a human resources employee and an investor relations employee refused to comment on the issue. Upper-level management at Geotek did not return phone calls.

Shark sees four options for Geotek that the new management can choose from, including finding a partner, being acquired, obtaining unacquired finances or dissolving the company.

"I think they are still trying to weigh their options," Shark said. "I still hope they can turn this around. They have been a very good member [of AMTA] and they offer a neat package of services."

The management transitions are just the beginning of changes at Geotek. The company and its domestic subsidiaries filed voluntary petitions seeking protection under Chapter 11 of the Bankruptcy Code on June 29. The filing, along with $10 million in debtor-in-possession financing, will enable the company to conduct business while negotiating a reorganization plan.

Although the plan is subject to court approval, Geotek expects to use all operating revenues from the continued sale of its communications systems and services, in addition to the $10 million debtor-in-possession commitment, to cover operating expenses. S-C Rig Investments III, L.P., an affiliate of the Soros Group, provided the $10 million commitment. Chatterjee is a director and president of S-C Rig Investments. Geotek employees will continue to receive their normal salary and benefits.

"The filing, coupled with the new financing, affords the company the opportunity to stabilize its financial situation, restructure its balance sheet and reinforce and maximize the underlying value of its business to attract additional investors or strategic partners," Spier said in a press release.

Reflecting the company's financial problems, Geotek's stock prices fell to 12 cents per share and attracted the attention of the NASDAQ Listing Qualifications Panel, which delisted Geotek's securities from NASDAQ on June 30, 1998.

As of March 31, 1998, Geotek Communications had consolidated assets (unaudited) of about $351 million and consolidated liabilities (unaudited) of about $424 million.

Lucent claims to cut E9-1-1 connect time

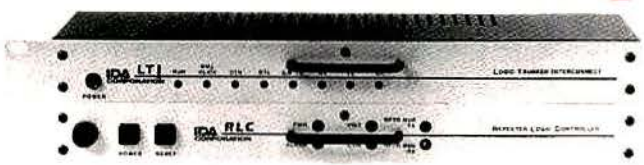
Lucent Technologies, Murray Hill, NJ, has formed a business venture that will help police and fire departments and other agencies respond to E9-1-1 emergency calls faster and more efficiently, even when calls are made from a wireless phone.

The Lucent Public Safety Systems venture has expanded its product offering with an integrated package of Palladium products and services. The Palladium products, designed by Bell Laboratories, include software for telephone network switches, caller location databases, E9-1-1 call answering equipment, computer-aided dispatch (CAD) systems and records management systems (RMS).

Bob Oliver, president of Lucent Public Safety Systems, said "Our latest offerings use high-speed ISDN signals and promise to cut average connect time for E9-1-1 calls from about eight seconds to about two seconds."

Connect time is the elapsed time between the end of a caller's dialing and the sending of a ringing signal from the E9-1-1 attendant's station. It is important because E9-1-1 callers frequently hang up and try again if they don't hear a ringing signal within a few seconds. Recent FCC orders mandate that E9-1-1 services for mobile telephony users allow the public safety agency to automatically receive information about the caller's location.

AT IDA WE DON'T PUT THE SAME PRICE ON PERFORMANCE AS THE OTHER GUYS.



450/800/900/220 MHZ COMPATIBLE.

Advanced SMR Trunking Logic and Interconnect that improves your return on investment because you invest less to begin with. That's why IDA makes the most SENSE.

IDA CORPORATION
1345 West Main Ave., Fargo, ND 58103
www.idaco.com

Call us today:
1(800)627-4432
1(701)280-1122
FAX 1(218)233-1886

Circle (53) on Fast Fact Card

FCC Notes

Phase II 220MHz service licenses to be auctioned

The FCC will hold an auction for 908 licenses to operate in the 220Mhz–222Mhz band. These licenses encompass the United States, Northern Mariana Islands, Guam, American Samoa, the U.S. Virgin Islands and Puerto Rico. The auction begins Sept 15. The schedule will be announced by public notice at least one week before the start of the auction. Bidding will be conducted on each business day until it has stopped on all licenses. It will be conducted as simultaneous multiple round bidding, and will be permitted from remote locations, either by computer or telephone.

The pre-auction deadlines are as follows:

Auction seminar, Aug. 6; short form applications (FCC Form 175), Aug. 17, 5:30 p.m.; up-front payments (via wire transfer), Aug. 31, 6 p.m.; orders for remote bidding software, Sept. 1, 5:30 p.m.; mock auction, Sept. 11, (TBA).

Cellular database becomes part of universal licensing system

The Wireless Telecommunications Bureau is developing a universal licensing system to unify 11 separate licensing databases and to provide greater efficiency in the licensing process. The licensing system will provide the public with electronic filing as well as online querying and mapping capabilities.

Previously, the bureau ensured the integrity of the cellular database by mailing each licensee a copy of its authorization on an annual basis, which provided an opportunity for corrections. Now, the bureau has created an opportunity to make these corrections via the Internet, allowing the database to be updated much more frequently.

Instructions clarified for Part 22 paging licensees filing renewals

The Wireless Telecommunications Bureau designated use of the Universal Licensing System for all processing of radiotelephone service (Part 22 applications). ULS provides significant benefits for Part 22 paging licensees, including the fast and easy filing of electronic renewal applications on FCC Form 601, designed specifically for electronic filing in ULS, and the automated processing of such applications.

MRT's publishing company changes name

On July 1, the name of the company that owns *Mobile Radio Technology* was changed from Intertec Publishing to PRIMEDIA Intertec. PRIMEDIA Intertec, Overland Park, KS, is the largest operating division of New York-based PRIMEDIA, a public company. It contributed nearly 20% of PRIMEDIA's 1997 sales of $1.24 billion. Intertec Publishing's president, Raymond E. Maloney, has been promoted to president of PRIMEDIA Intertec. He said the name change is part of a comprehensive branding strategy begun in October 1997 by PRIMEDIA.

"Our company will only continue to prosper and grow through its partnership with PRIMEDIA's powerful media brands," Maloney explained.

Within PRIMEDIA Intertec, the company's magazine groups have been renamed as five market-focused magazine divisions. Cameron Bishop, previously the senior vice president of Group II, has been promoted to president of the Communications & Entertainment Division. Along with *MRT*, the division includes magazines that serve the telecommunications, wireless communications, entertainment and apparel industries.

CRITICAL SITUATION. SECURE COMMUNICATION.

With the situations you face on a daily basis, consistently clear communications is crucial. There is no room for error...no time for interruptions, unclear transmissions or connection failures. Your two-way radio accessories should be reliable, durable and provide high-clarity sound...as well as be compatible with a wide variety of two-way radio equipment.

OTTO Communications' product line includes:

- Remote Speaker Microphones with Earphone Jack.
- Lightweight Headsets.
- Low-Profile Earphone Kits with Palm Mic or Mini-lapel Mic.
- Noise-Attenuating Headsets with certified NRR of 24dB.
- Earphones and many other alternatives.

The quality and reliability you deserve... to serve and protect you. Contact us today by phone, fax or E-mail, or come visit our website.

Your Specialists In Two-Way Radio Accessories

OTTO® COMMUNICATIONS

2 East Main Street ◆ Carpentersville, IL 60110
Toll-free: 888-234-OTTO ◆ Phone: 847-428-7171 ◆ Fax: 847-428-1956
E-Mail: comsales@ottoeng.com ◆ Internet: www.ottoeng.com

ISO 9001 REGISTERED

See us at APCO, booth #2212.

Circle (36) on Fast Fact Card

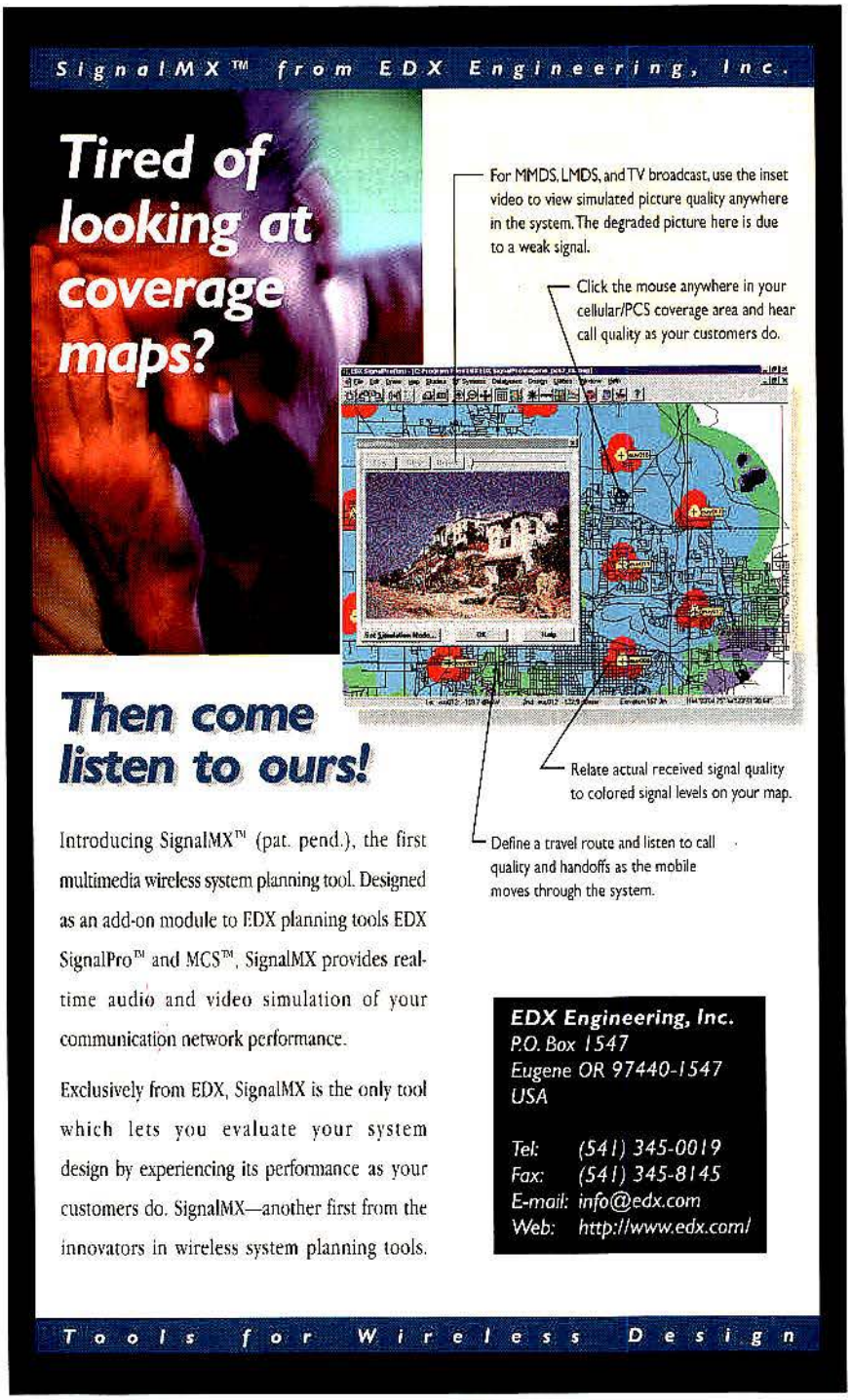
Hutton uses 'electronic commerce' to improve customer service

Weber

With customer service in mind, Hutton Communications, Carrollton, TX, is turning to electronic commerce applications including extensive email communication with customers and an interactive CD-ROM catalog. The CD-ROM catalog, which Hutton plans to migrate to its Web page on the Internet, allows customers to view inventory and product specifications, and to compare similar products to make a final decision. The catalog, and eventually the Web site, can accept orders at any time of the day. This is an advantage for customers, according to Randy Weber, electronic commerce manager for Hutton. "We're trying to get a better handle on what our customers want," he said. "It has literally changed the way we do business."

Weber also stressed the importance of email in customer service. Instead of using long-distance phone calls for technical questions, Hutton has set up email addresses for each of its six U.S. branches. Customers can use the email to ask questions, and to place and track orders. This process is much more efficient than standard phone calls, and Hutton has a policy of answering all electronic inquiries within one business day, said Weber. Weber explained that using email saves customers time and frustration caused by placing phone calls during business hours and enduring multiple transfers while the person answering the phone searches for someone who can answer the question. The process also saves money for the company by reducing long-distance bills and shortening hours that the phone lines must be staffed. "The idea is that we can provide (customers) with the information they need when they need it," Weber said.

In addition to these projects, Hutton has updated its Web site for faster service with more available information, and has begun to look at ways to incorporate its own Web site with that of its subsidiary, Hutton Communications Canada. Hutton has also implemented an in-house Intranet to improve communication among employees.



Circle (37) on Fast Fact Card

Trimble, Midwest Traffic join to offer GPS-AVL

Trimble Navigation, Cincinnati, and Midwest Traffic Products, Romeoville, IL, have signed an agreement to combine resources for GPS-based automatic vehicle location and traffic signal pre-emption. Emergency response and transit vehicles equipped with Trimble's AVL systems will be able to request green signals at intersections based on GPS information. Traffic signal pre-emption could save lives and property by allowing faster and safer response for emergency vehicles. It can also reduce overall traffic congestion for public transit vehicles by cutting travel times and improving adherence to schedules.

Under the agreement, MTP will resell Trimble's GPS-based traffic signal pre-emption system with AVL and central dispatch capabilities. In turn, Trimble will have the ability to integrate MTP's signal pre-emption capabilities. The integrated system uses the same GPS receiver for both fleet management and traffic signal pre-emption.

The first contract for the integration of the traffic signal pre-emption with AVL was placed by Palm Beach County, FL, for 95 intersections and 103 vehicles in April 1998.

Trimble's GPS/AVL subsystem is a comprehensive system of fully integrated products, including a PSC-200 intelligent data controller with a built-in GPS receiver, an EchoxI message data terminal and base station software packages for AVL management and communications control.

ANSI approves Project 25 common air interface

The American National Standards Institute (ANSI) has approved the Telecommunications Industry Association's (TIA) standard, the Project 25 Common Air Interface.

"The document begins to satisfy two of our primary original objectives in Project 25," said Art McDole, Project 25 co-chairman. "This new standard will help ensure public safety agencies are able to buy Project 25 communications products in an open and competitive marketplace," he said

Utilities report need for more spectrum

Following a comprehensive, one-year study, UTC's USAT (Utilities Spectrum Assessment Taskforce) released a report at the UTC Annual Conference and Exhibition on June 30, confirming the need for the new spectrum to meet utilities' needs in the first decade of the 21st century.

Findings were based on original survey data, projections from historical data and the methodology from the Public Safety Wireless Advisory Committee (PSWAC) process, as applied to utilities and pipelines. The task force found the following:

❑ The total new spectrum required by the year 2000 will be an additional 1MHz, with 1.9MHz more by 2005 and 6.3MHz more by 2010.

❑ There will be an increase in the use of wireless applications, and utilities will need additional spectrum to accommodate these applications.

❑ There is substantial interest within the utility community to implement wireless video and wideband data. As technology improves and the cost of terminals decreases, it will become more common for the utility industry to deploy these technologies.

The USAT report was prepared by representatives of UTC member companies, including utilities and radio manufacturers and focuses for the first time on identifying future applications and quantifying the wireless bandwidth needed to provide them. The next step will be to find ways to access the additional spectrum, such as reallocation of additional spectrum and development of new technologies that will permit improved use of current and additional frequencies.

The UTC report noted that new applications of wideband data and video will become important for efficient operation of utilities in the next century. Utilities will have increased requirement for traditional wireless applications of voice and data as electric utilities restructure. Vertically integrated utility companies could divest into operational components, such as generation, transmission, distribution and retail marketing.

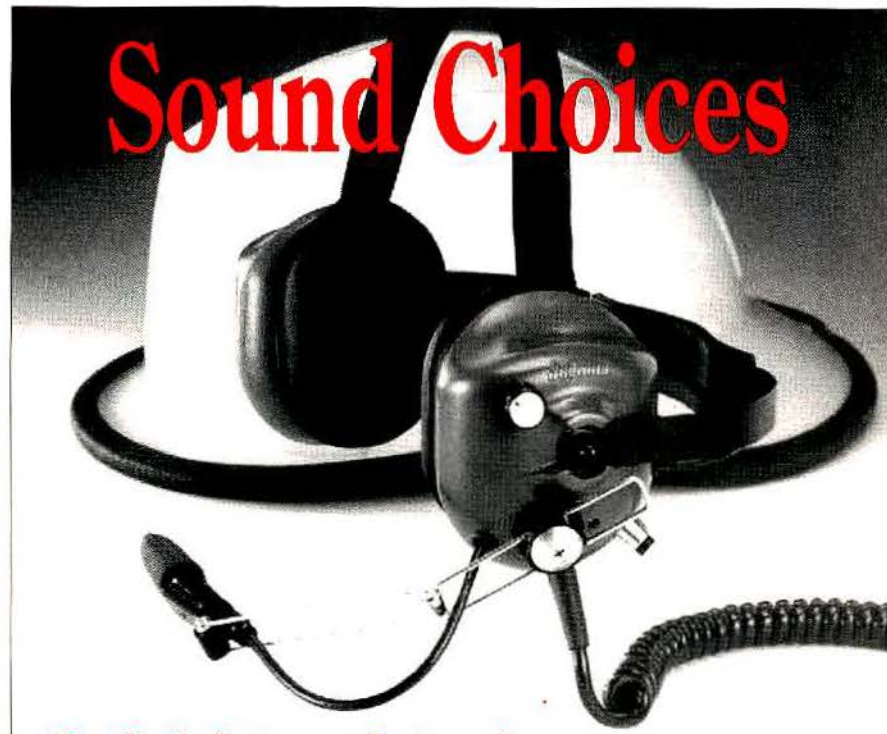
Indiana State Police launches communications project

Indiana has begun a long-awaited project to replace its present outdated public safety voice radio communications network announced Indiana State Police Superintendent Melvin Carraway. The new integrated system, based on state-of-the-art 800MHz digital technology, will replace numerous systems that have deteriorated since they were first installed, some more than 25 years ago.

Superintendent Carraway said that the new system has received the strong support of Indiana's integrated law enforcement council (ILEC). It will not only provide seamless voice communications, but also will enable more effective field operations by supporting mobile data communications.

Carraway said, "Public safety agencies throughout Indiana will be able to communicate not only clearer, faster and more reliably, but interagency communications for mutual aid among local departments and the state will be greatly improved."

The state retained The Warner Group, Woodland Hills, CA, to develop a comprehensive strategic plan and system design.



Our Radio/Intercom Systems have...

Performance Designed In

Meet NFPA standards with the best sounding noise attenuating headsets available, headsets that can also be used with your portable radios. Engineered RFI/EMI and ground loop protection. Product reliability developed through 22 years experience justifies our two year warranty, a benchmark for the industry.

System 900

A single radio model with basic features cuts cost not corners. Headset has PTT and volume control; uses standard 1/4" phone plug.

System 930

A dual radio system designed for use with EMS vehicles. Offers simultaneous transmission, balance controls, intercom mute and more.

Cost Designed Out

All models are fully-assembled and easily installed. Our full line of single and dual radio systems ensures that you receive needed performance for the lowest cost.

Also Available:

- System 1300 with Split Audio for ARFF vehicles
- Pumper Panel/Driver Headset for vehicles not requiring intercom systems.

See us at APCO booth #1916

SOUND IDEAS FROM Setcom CORPORATION

http://www.setcomcorp.com

1400 N. Shoreline Blvd. • Mtn. View, California 94043-1385 • Tel: 1-800-966-1034 • 650-965-8020

Circle (38) on Fast Fact Card

MORE LARSEN INNOVATION...

Are you seeing **SPOTS!**

You should be.

Larsen, a leader in wireless communications antennas for over 30 years, introduces **SPOTS!** high performance portable antennas. . .Antennas with a difference you can hear!

Hear this. . .
Not All Portable Antennas Are Created Equal

Portable antennas often endure extreme operating conditions and physical abuse. In addition, actual performance varies greatly depending on antenna type. This makes selecting the right portable antenna a challenge. Larsen **SPOTS!** are designed and built to withstand the most demanding applications and provide superior electrical performance for clear, continuous communications.

Hear this. . .Design and Materials Make a Difference

Larsen utilizes advanced electrical designs, and premium materials to produce **SPOTS!** portable antennas. Copper plated, hard drawn steel and bronze coated steel braid provide superior signal radiation with maximum structural integrity. Each antenna is covered in the toughest OEM specified polyurethane compound for resistance to water, cracking or permanent bending.

For more information on **SPOTS!** portable antennas, or a free copy of the Larsen Portable Antenna SourceBook and Training Guide featuring SPOTS!, contact Larsen at 800-426-1656.

SPOTS!. . .Hear the Difference.

Larsen®

800 426-1656 U.S. 800 663-6734 Canada
www.larsenet.com e-mail: larsen@larsenet.com

Circle (39) on Fast Fact Card

Icom Funmobile tours United States, Canada

ICOM America, Bellevue, WA, is sending its Funmobile, a 29-foot van loaded with communications equipment, around the United States and Canada. ICOM employees are taking turns driving the van to various retail stores and industry trade shows. The van features pilot, boating, public safety, ham and SWC communication equipment.

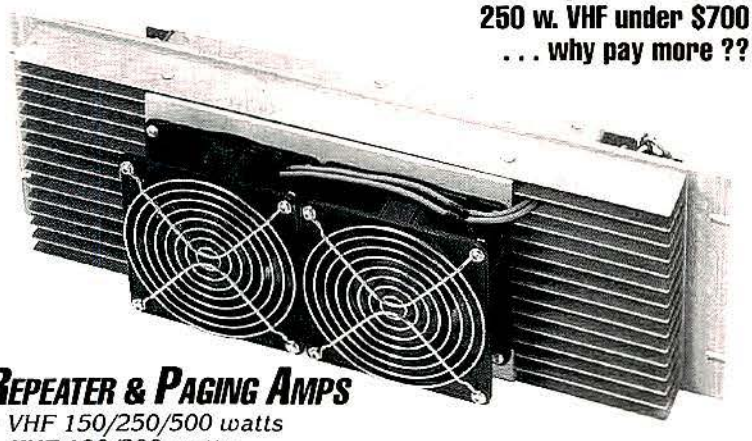
The company hopes the tour will build awareness of the types of equipment that ICOM produces. ICOM also uses the Funmobile for hands-on training of end-users and retail sales staff.

The tour began in April in the northwest United States and will continue through the fall. ICOM has generated an enthusiastic response from its effort. Thousands of people have visited the Funmobile at its various locations, and the company has received many positive comments from both users and retailers.

A Funmobile itinerary can be viewed via the Internet at *www.icomamerica.com.*

PAGING AMPLIFIERS

WOW . . . 200 w. UHF Amps under $1000
250 w. VHF under $700
. . . why pay more ??



REPEATER & PAGING AMPS
- VHF 150/250/500 watts
- UHF 100/200 watts
- 800 MHz 60 watts

For 20+ years, Henry Radio has been producing low cost, reliable paging and repeater amps. All common bands, power ratings and configurations are available. Call today for specifications and prices.

TOLL-FREE (800) 877-7979

HENRY RADIO

2050 South Bundy Drive
Los Angeles, CA 90025

Phone (310) 820-1234
FAX 310-826-7790

96 MA

Circle (40) on Fast Fact Card

Cerulean expands mobile info application suite

Cerulean Technology, Marlborough, MA, has announced a new component of its Packetcluster mobile information application suite that enables police officers in the field to collect data, enter information and upload and update reports, from their patrol cars. Packetwriter field reporting streamlines the documenting, writing and storing of reports while extending the computing desktop from headquarters to the patrol car.

Together, Packetwriter and Packetcluster Patrol provide wireless connectivity across multiple radio infrastructures, integration with back office records systems and interoperability with other desktop applications.

Blue Ridge Jail members join area radio system

Three of the five members of the Blue Ridge Regional Jail Authority (BRRJA) will be joining the Central Virginia Regional Radio System in a deal allowing the BRRJA to just purchase radios instead of a completely new communications architecture.

Nearly two years ago, the cities of Lynchburg, VA, and Bedford, VA, and the counties of Bedford and Amherst purchased an $11.7 million system from Ericsson to support radio communications for their public safety agencies that would allow seamless interoperability between the municipalities. The BRRJA will operate on this infrastructure.

Participating users of the BRRJA are Lynchburg, Bedford and Moneta. These users will use the system to cover on-site communications and communications made during the transportation of prisoners.

The Central Virginia Regional Radio System is scheduled to come on-line later this year, and the BRRJA will begin using its radios in simplex mode this summer.

IBM offers real-time access to databases

From the safety of the patrol car, law enforcement officers can now have real-time access to information from local, state and federal databases, including criminal, vehicle and driver information with IBM's Enetwork Law Enforcement Express.

The system extends the reach of host– and Web–based applications to the mobile patrol force by allowing law enforcement agencies to use Internet and intranet informtion in real-time. Based on client/server architecture, it features a graphic interface that is activated by the touch of a pen, keyboard or mouse, and runs on a variety of mobile hardware platforms, from basic laptop computers to units specifically designed for public safety.

CommServe to market Gabriel products

Gabriel Electronics, Scarborough, ME, and CommServe Marketing, Canada, have entered into an agreement for CommServe Marketing to market Gabriel products throughout Canada.

CommServe will be marketing Gabriel's line of terrestrial microwave point-to-point antennas, point-to-mulitpoint antennas, cellular base station antennas, coaxial cable, elliptical waveguide, rigid waveguide components and related accessories. Gabriel also carries a line of pressurization equipment for communications systems.

American TriTech changes name, releasing software

American TriTech, San Diego, changed its name to TriTech Software Systems in June.

"We are an international company, and wanted our name to have broad, international appeal," said Christopher D. Maloney, president of TriTech.

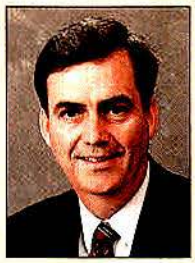
Maloney said the company chose to announce the change at this time because it is releasing VisiCAD for Law Enforcement later this year. This program will allow users to dispatch all three agencies (fire, police and EMS), using a single program.

Circle (54) on Fast Fact Card

News Notes

World Wireless Communications, Salt Lake City, has opened a SCADA and Telemetry division in Kansas City, MO. The division develops SCADA (supervisory control and data acquisition) and telemetry systems for oil and gas production, vending machines and weather data collection. "The SCADA and telemetry systems being developed by our new division will augment and service our current telemetry contracts as well as expand World Wireless' presence in the Midwest," said **David Singer**, president of World Wireless. The division will also develop products used to monitor vending machines, pipelines, water tanks and personal protection systems, said **Don Wallace,** vice president of the SCADA and Telemetry Division.

BellSouth, Atlanta, has assumed 100% operational control of **RAM Mobile Data USA** and has renamed the business "BellSouth Wireless Data." "We are excited about this opportunity to have the power of the BellSouth brand behind our efforts to increase the presence of our company in the rapidly expanding marketplace," said **William F. Lenahan,** president of the new BellSouth Wireless Data.



Lenahan

Midland USA, Kansas City, MO, and **Uniden Private Radio Communications,** Fort Worth, TX, have agreed to market Midland's LMR products with Uniden's advanced ESAS system. "ESAS has proven itself to be a reliable, affordable and beneficial enhancement to the standard LTR protocol, and this is being recognized by the growing list of manufacturers that are offering ESAS products," said **Sal Farina**, Uniden Private Radio Communications' vice president of domestic sales.

Dataradio, Atlanta, will integrate its Collision Avoidance Radio Multiple Access (CARMA) mobile data technology with a 48MHz, low-band voice radio infrastructure from **Cleco**, Pineville, LA, to provide Cleco with a mobile computing system that uses its existing private radio network. "The Dataradio solution made it possible for us to utilize our existing radio network," said **Sonny Carter**, Cleco's manager of distribution operations. "We were in pretty big trouble. Dataradio saved this project."

CPI Communications has moved to a new location. The new address is: 941 Hensley Lane. Wylie, TX, 75098. The new phone number is 800-869-9128, and the fax is 888-437-5360.

The **Jefferson Parish Sheriff's Office,** Gretna, LA, has tested its digital 800MHz voice and data two-way radio systems at the **Motorola Customer Center for Systems Integration** in Schaumburg, IL. "The new data system will provide officers in the field direct access to computerized law enforcement databases that will give them the information they need in a wide variety of situations," said **Harry Lee**, sheriff of Jefferson Parish.

Jefferson Parish Sheriff's Office radio communications installation. (Left to right) Chief Deputy Newell Normand, Deputy Chief John Day, consultant Leo Holzenthal and Deputy Chief Craig Taffaro.

Glenayre, Charlotte, NC, and **PageNet**, Plano, TX, signed a multiyear volume purchase agreement for a nationwide, two-way narrowband PCS paging system. Under the agreement, Glenayre will install infrastructure and software to migrate PageNet's one-way networks to high capacity two-way voice and data networks. The companies also signed a second volume purchase agreement for the supply of Glenayre's word-messaging acknowledgment pager, the AccessMate. "We are very pleased to offer PageNet an end-to-end system solution that provides them with cost and performance advantages," said **Gary Smith**, president of Glenayre.

CMC Distributing, Van Nuys, CA, changed its corporate name to **Electro-Comm West** to better reflect the company's focus on distributing RF telecommunications products and its separation from **Communications Marketing Company**, a manufacturer's representative company. All the employees, phone numbers and addresses associated with the former company remain the same. Along with the name change, the company also plans to expand its product offering.

Motorola has appointed **Leavitt Communications**, Skokie, IL, an authorized distributor of the new Motorola 900MHz Creatalink paging control module. "Creatalink is the first of a new generation of one- and two-way paging products with virtually unlimited potential," said **Philip Leavitt**, president of Leavitt Communications.

The **Antenna Specialists** and **Decibel Products** divisions of **Allen Telecom**, Cleveland, OH, named **Stinson Associates,** Havertown, PA, as its 1997 Representative of the Year.

The city of Richmond, CA, selected **Ericsson** to provide digital access trunked radio systems for its agencies in an $8.3 million contract. Richmond will receive a five-channel, four-site GPS simulcast system with six C3 Maestro consoles for Windows NT for its police, fire and public works departments, as well as its housing authority.

The National Institute of Standards and Technology (NIST) has issued a FIPS 140-1 Validation Certificate to **Transcrypt International**, Lincoln, NE, for its SC20-DES two-way encryption module. The FIPS 140-1 certification recognizes that the device has met the stringent security requirements of cryptographic modules that protect sensitive but unclassified information within a computer or communication system. As an aftermarket encryption module for two-way radios, the SC20-DES secures communication by utilizing DES algorithm to encrypt digitized voice audio. "Engineering a product which meets the stringent standards of NIST and provides a digital security solution for radio users around the world is a testament to our research and development process," **Joel Young**, Transcrypt's vice president of engineering, said.

Calling auctions "an inappropriate mechanism" for licensing private internal systems, the **Industrial Telecommunications Association**, Arlington, VA, has asked the FCC to implement a system of efficiency-based lease fees to license the spectrum allocations requested in the Land Mobile Communications Council's (LMCC) April 22 Petition for Rulemaking. ITA urged the FCC to take an active role in pursuing the lease-fee authority from Congress.

The TSM-2000 Card Access System, developed by **Hark Systems**, Summerville, SC, will be used on the 83rd floor of the Empire State Building to control access and to monitor the status of environmental readings in the communications suites, such as temperature and moisture conditions.

Flagship Marketing will represent **PanaVise Products**, Reno, NV, in Texas, Arkansas, Louisiana and Oklahoma. "We are very pleased to add Flagship to our sales team," said **Gary Richter**, PanaVise president.

The American Mobile Telecommunications Association (AMTA) applauds the release of an FCC Public Notice announcing the new start date for the auction of Phase II 220MHz licenses. AMTA especially noted the FCC Wireless Telecommunication Bureau's decision to reduce some upfront payments and minimum opening bids for the auction, now scheduled to start Sept. 15, 1998. "As we've stressed all along, the small amount of spectrum in each license and lower infrastructure costs for 220MHz make this industry a real opportunity for small business participation, if the auction costs themselves are reasonable," said Alan Shark, president of AMTA.

Shark

Site security

Intrusion alarm software uses FM to reduce monitoring airtime

Pacific Circuit Design has redesigned the Watchdog for adaption to the expanding wireless intrusion alarm market. The Watchdog has software features that allow monitoring of numerous stations on existing FM radio systems, with little effect on normal communications voice traffic. This adaptation allows trunking system owners to increase their monthly revenues by offering the alarm services without sacrificing large amounts of airtime for alarm monitoring. The PC software provides a time-and-date stamp on all system activities.

Circle (351) on Fast Fact Card

System features visual verification

Motorola's RIX is designed for public safety, utility and security professionals who need to know what is happening at remote sites. Visual verification of abnormal remote-site conditions, traditionally detected by motion, temperature and other sensors, is now available with the RIX radio image transmission system. Data speeds as high as 19.2kbps allow typical small images to be collected every three seconds. Longer acquisition times may be required by the communication system design, communication path length and image compressibility. RIX typically operates on two-way radio channels and offers enhanced applications for alarm verification, industrial site monitoring, fire monitoring and traffic control.

Circle (352) on Fast Fact Card

Monitor automatically phones, pages 16 numbers continuously

Antx has developed the ADAS Dialog alarm monitoring and notification system that automatically phones or pages as many as 16 numbers from a single or series of alarm conditions. The system continues to call, giving user-recorded messages, until all alarms are acknowledged. This ensures that appropriate personnel are notified of critical conditions. Key features include notification via phone, pager, radio or modem; callback alarm acknowledgment; remote programming; remote call-in for status; NEMA 4× enclosure; as many as 40 alarm points monitored continuously; event logging; 24-hour battery backup; surge and power loss protection; local programming via keypad and local visual display of system and alarm status.

Circle (353) on Fast Fact Card

Monitor features card access

Hark Tower Systems manufactures tower site monitoring and card access equipment. The Hark TSM2000 can be applied to virtually any type of site and provides the owner/manager with an alarm reporting platform that can control entry to buildings, monitor existing light control equipment, and provide one point for reporting site alarms and conditions. Detailed reports of all events are available including the entries, date, time and identity of who entered, which can be stored and printed.

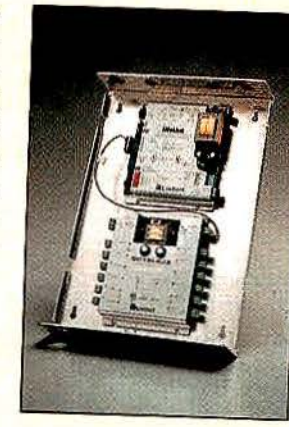
Circle (354) on Fast Fact Card

Monitor reports 240 conditions

The B1280 FLX from **Barnett Engineering** can monitor and report as many as 240 alarm conditions, including temperatures, loss of events, battery voltage and current, site intrusion, totalizers, VSWR and RF power. Alarms can be reported and acknowledged over telco lines, cellular or satellite telephones, or conventional and trunked mobile radio systems, RS-232 ports, tone and alphanumeric pagers. There are output relays that allow for the remote operations of fans, sirens, switches and other devices until maintenance personnel arrive to perform adjustments and repairs. Typical applications include monitoring of vital conditions at joint-use VHF, UHF repeater sites, cellular, paging and PCS sites.

Circle (356) on Fast Fact Card

System allows two-way communication between sites



Liebert has developed Sitelink, a building management system communications interface. Sitelink's microprocessor-based control module provides two-way communication between the existing building management system and environmental, power and uninterruptible power supply products. Sitelink has a 32-bit architecture that relays critical operating information between equipment and Modbus or Sitescan central monitoring systems.

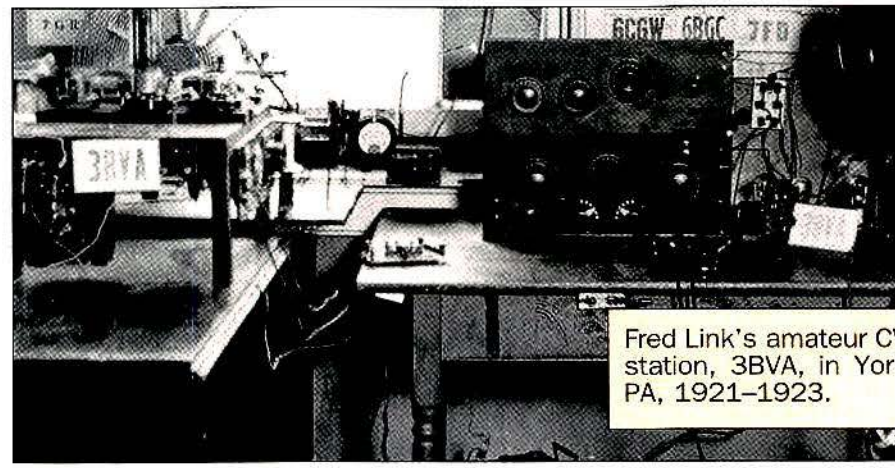
A single unit can control as many as 12 information gathering modules for cost-saving monitoring, reset of alarms and critical operating parameters.

Circle (355) on Fast Fact Card

Continued from page 24

know—and he knew almost everyone. In recent years, as his eyesight weakened, he wanted help at the many trade shows he attended. I accompanied him so often that people started calling me his "bodyguard." I told him he was a "people magnet," because he attracted so much attention as we walked the exhibit aisles. "I prefer 'goodwill ambassador,' Don, if you don't mind," he said.

Fred and his wife, Mildred, raised two daughters, Daryl, who died several years ago, and Joanne. They also raised American Saddlebred horses. "I can't say that horse-breeding made any money," Fred said. "But it brought me in contact with all the right people." The horses usually were ridden in competition by the Links' daughters. Their home, Robin Hill Farm, in Pittstown, NJ, contains countless awards and photographs from horse shows.



Fred Link's amateur CW station, 3BVA, in York, PA, 1921–1923.

Fred led the Radio Club of America as president for 23 years, which also figured in the success of his consulting business.

Now you know something about Fred's life, but you shoulda heard his *stories*. Like the "Great Texas Antenna Shoot," wherein Fred's customer and benefactor, oilman Jim West, organized a shooting party to "remove" a base station antenna that was mounted too high. And the "Radio Equipped Horse-drawn Delivery Cart" that, thanks to a New York City ordinance, always went ahead of motorized trucks at the docks to pick up supplies for Link Radio. And the "Electric Windows That Sold the Radios," wherein foreign buyers, fascinated by electric windows on a Cadillac given to Fred by Jim West, agreed to a purchase while spending most of their time working the windows instead of watching the demonstration of radio equipment in the car.

And the "Lyndon Johnson Waiver," wherein the then-Senate majority leader called the FCC and obtained a waiver for Fred to install 3,000-watt VHF lowband base stations to communicate by skip with mobiles and airplanes across the United States. And Fred's travel to Havana and Mexico City to sell police radios. And many more.

Fred used to tell me, "Don, don't get old; you won't like it."

I would say, "First of all, what's the alternative? Second, if you're any example, what's wrong with it?"

"I guess you're right," he would concede. "I've been lucky."

Fred *was* lucky, although he also was *prepared* to take advantage of the opportunities that good fortune brought him, and he *recognized* those opportunities, and that made the difference. And I know I was lucky to know him.

God bless you, Fred. ■

DISPATCH SOLUTIONS

Introducing Instrument Associates' quality and feature-packed solutions at prices everyone can afford.

- 2 Year Warranty
- User/Installer Manual Included
- IA Quality and Support

ILD1000 LOCAL DESKSET

Selectable Monitor
Intercom
Selectable Parallel Transmit Audio Mute
Selectable Off-Hook Monitor
Selectable Local Speaker
Full-Duplex Capable Handset
Front-Panel Audio Mute and Unmute
Parallel Transmit and Monitor LEDs
Internal Microphone and Speaker

ITR1000 TONE REM. DS

Programmable 4-Frequency/ Function Control
Parallel Transmit Audio
Intercom Capability
Selectable Off-Hook Monitor
Selectable Off-Hook Local Speaker
Front-Panel Audio Mute and Unmute
Internal Microphone and Speaker

IDR1000 DC REM. DS

Programmable 4-Frequency/ Current Control
Parallel Transmit Audio
Intercom Capability
DCLOTL
Selectable Off-Hook Local Speaker
Front-Panel Audio Mute and Unmute
Internal Microphone and Speaker

IDA1000 DC REM. ADAPTER

Multiple DC Remote Deskset Support
2-Channel Control
Monitor
Full-Duplex Capable with 2-or 4-wire
Adjustable Receive Input Sensitivity and Transmit Output Levels
Selectable Input/ Output Logic Control
Accessory Port
Modular Phone-Line Connections on Back

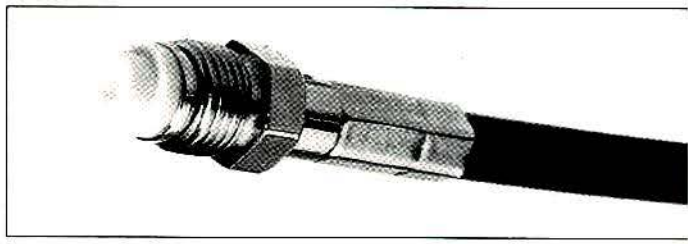
GAI-TRONICS CORPORATION
Instrument Associates Division

2455 Harbor Avenue
P.O. Box 13127
Memphis, Tennessee 38113
Voice: 888.254.9155
Fax: 901.948.8855
E-Mail:
iainfo@gai-tronicsIMR.com
www.gai-tronicsIMR.com

Circle (55) on Fast Fact Card

Mobile antenna mounts now feature FME universal connectors

Maxrad's mobile antenna mounts are available with FME universal connectors. The diameter of an FME connector is slightly greater than the cable it is attached to, so faster antenna installations result. The feature allows an installer to pull the antenna mount's cable and factory-installed connector through a vehicle. When the cable reaches the radio or phone, the installer attaches the appropriate threaded adapter, which connects with the radio's antenna port, to the threaded FME universal connector. The FME universal connector is available with all Maxrad mobile antenna mounts including ¾" hole, magnetic, trunk groove and trunk lid mounts.



Circle (401) on Fast Fact Card

Impedance analyzer features graphical and digital displays

AEA's CIA-HF hand-held graphic complex impedance analyzer is for tuning, testing and designing antennas or any tuned circuits in the 400kHz to 54MHz frequency range. The CIA-HF offers displays of SWR, vector or absolute impedance, resistance, reactance and voltage. It can determine the Q factor or bandwidth between any selectable SWR points, and the correct conjugate match inductor or capacitor value to tune an antenna properly.

Circle (402) on Fast Fact Card

READER'S CHOICE

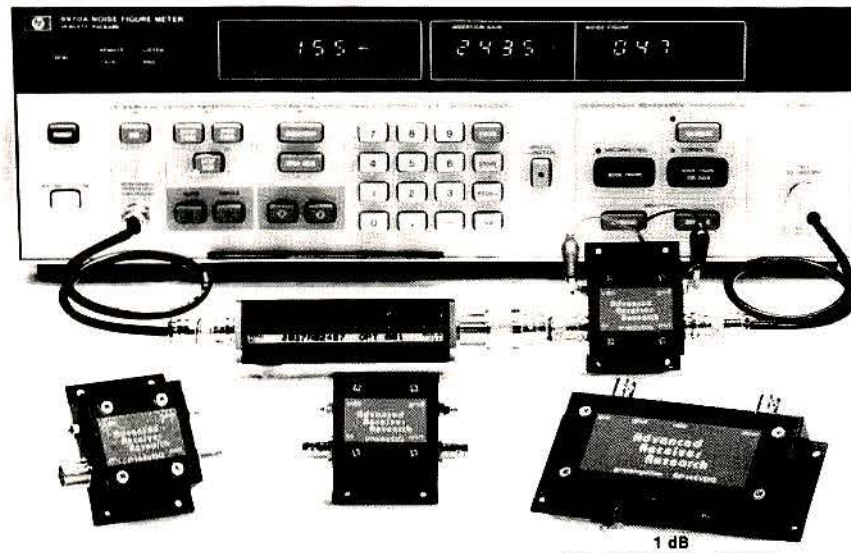
Of all the new products and services in the January 1998 issue, the one reprinted here generated the most reader requests for additional information. If you missed it the first time, here is your opportunity to acquire more information about it. Just circle the corresponding Fast Fact Card number on the card found in the back of this issue, and mail the card to us.

Vehicular repeater extends hand-held range

Pyramid Communications' model SVR-214 provides extended range for a UHF or VHF hand-held by crossband repeat with an existing mobile. The SVR-214 is Motorola PAC/RT, PC-programmable and capable of 14-channel operation, allowing the use of several portable frequencies without reprogramming the vehicular repeater. The repeater features priority sampling, "first man out," multivehicle operation, local mic repeat and adjustable power as great as 2W.

Circle (500) on Fast Fact Card

High Performance vhf/uhf preamps



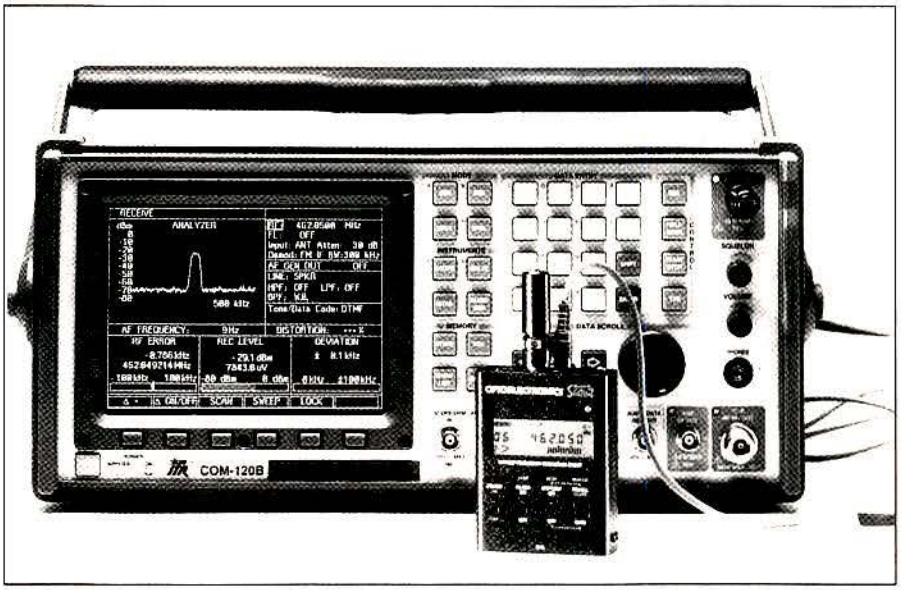
Receive only	Freq. Ranges (MHz)	N.F. (dB)	Gain (dB)	1 dB Comp. (dBm)	Device Type	Price
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET	$ 44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET	$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET	$ 44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET	$ 56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET	$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	−20	Bipolar	$ 49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	−20	Bipolar	$ 74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET	$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET	$119.95
Inline (rf switched)						
SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET	$ 74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET	$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET	$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET	$ 86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET	$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	−20	Bipolar	$ 79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	−20	Bipolar	$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET	$139.95

Every preamplifier is precision aligned on ARR's Hewlett Packard HP8970A/HP346A state-of-the-art noise figure meter. RX only preamplifiers are for receive applications only. Inline preamplifiers are rf switched (for use with transceivers) and handle 25 watts transmitter power. Mount inline preamplifiers between transceiver and power amplifier for high power applications. System S/N improvement 6-14 dB typical. Other amateur, commercial and special preamplifiers available in the 1-1000 MHz range. Please include $2 shipping in U.S. and Canada. C.O.D. orders add $2. Air mail to foreign countries add 10%. Order your ARR RX only or inline preamplifier today and start hearing like never before!

Advanced Receiver Research

Box 1242 • Burlington, CT 06013 • 860-485-0310

Circle (60) on Fast Fact Card



Frequency recorder features 400 memories

The Super Scout from **Optoelectronics** is a hand-held frequency recorder that locks onto a signal from 10MHz–1.4GHz in less than one second. With its built-in serial interface, the recorder interfaces to the IFR COM-120B or IFR 1200 with a serial port, using the supplied cable. Once the recorder captures a frequency, it automatically tunes the IFR service monitor to that frequency. The COM-120B can be tuned in receive mode as well as spectrum analyzer mode. Reaction tuning the service monitor can save time and money. With virtually no set-up time involved, the two-way communications professional will be able to test many more radios in a day, a week or all year. In addition to its reaction tune capabilities for the IFR, the recorder also has 400 memories.

Circle (403) on Fast Fact Card

Desktop controller offers local extended control

The ILD2000 local deskset from the **Instrument Associates Division** of Gai-Tronics gives users local extended control. Features that were traditionally optional now come standard with the deskset. Selectable monitor, intercom, internal intercom, full-duplex capability, selectable parallel transmit audio mute, selectable off-hook monitor, and keypanel programmable controls and adjustments increase deskset users' dispatch power and productivity. Adjustable input sensitivity, adjustable transmit output level and selectable output logic provide audio quality and flexible radio-system set-up.

Circle (404) on Fast Fact Card

Ear inserts allow use of telephone simultaneously

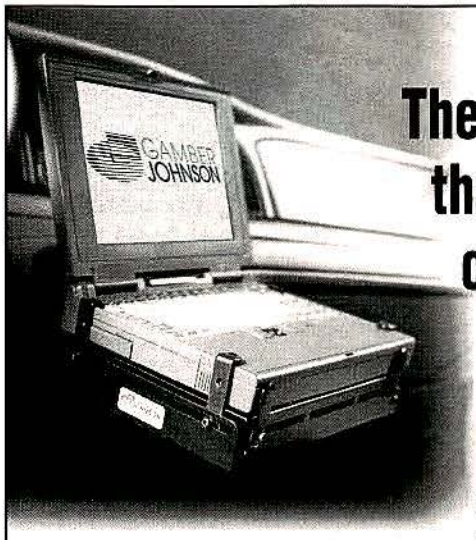
Otto Communications' flexible, open ear inserts conform to the shape of the ear, permitting the use of a telephone or headset while wearing the ear insert. The headsets allow the user to hear ambient noise with their open-frame design, while fitting entirely inside the ear. They are compatible with Otto acoustic tube assemblies. They are also molded from ultra-flexible, hypo-allergenic plastic, and are available in three sizes, with right- and left-ear versions.

Circle (405) on Fast Fact Card

Dispatch system available for rental with new program

TriTech Software Systems now offers its VisiCAD dispatching system through a new rental program. The program, VisiCAD on Demand, supports enhanced operational flexibility, scalability and versatile asset management for customers. The enhanced rental program is based on an existing software rental program TriTech has offered for more than two years. The company expanded the new program to include all components of a VisiCAD system, such as software, hardware, support, maintenance, user training and installation. With this program, TriTech will provide all hardware, software and service components of its Windows NT-based dispatch system under a comprehensive monthly rental plan. The program will provide for automatic software upgrades and all support, installation and training services. In addition, all computer hardware will be upgraded to state-of-the-art computer technology as often as every 24 months.

Circle (406) on Fast Fact Card



The only mount that will keep your computer from Crashing

Save more than your data in a crash.

Gamber-Johnson's NotePad™ mounts have withstood more years of punishing driving than any other mount...keeping laptops secure even in the case of accidents. That means greater safety for equipment and passengers.

Only Gamber-Johnson's NotePad™ gives you:

- Optional shock isolator that reduces jarring and road vibration for your laptop.
- A quick release latch to secure and remove your laptop easily.
- More accessories than any other mount.
- Versatility to fit virtually any model laptop and can be mounted in most vehicles.

Insist on the original NotePad™ mount.

GAMBER JOHNSON
Answers. Solutions. Results.

Stevens Point, WI • 1-800-456-6868 • Fax: 1-800-934-3577
e-mail: gamberj@coredcs.com • website: www.gamberjohnson.com

Circle (61) on Fast Fact Card

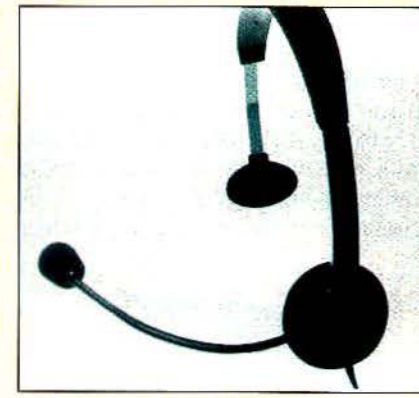
Filter solves problem of transmission interference

Ultra-Q from **AeroComm** is a cost-effective solution to an existing problem created by paging and cellular transmission interference on Multiple Address Systems (MAS). These and other disruptive signals render many systems inoperable. The implementation of Ultra-Q permits normal operation of the MAS by eliminating extraneous, troublesome transmissions. Within the frequency ranges of 928MHz to 953MHz, the unit is frequency-agile with channel spacing of 6.25KHz. Ultra-Q is only one of an array of standard filters designed and manufactured by AeroComm. Using the same techniques, AeroComm filters are available in the VHF/UHF bands.

Circle (407) on Fast Fact Card

Lightweight headset fits BK radios

TwitCo Distributing's ParMarLow lightweight headset (HD-PWH2100) series is designed for BK radios. The design features an enclosed headband adjustment with moveable rubber cover. This provides easy adjustment with no metal ends to catch on clothing or hair. The adjustable boom microphone and soft ear pad offer additional comfort features. The HD-PWH2100 headset is available for Motorola, Ericsson, Uniden and Kenwood radios.

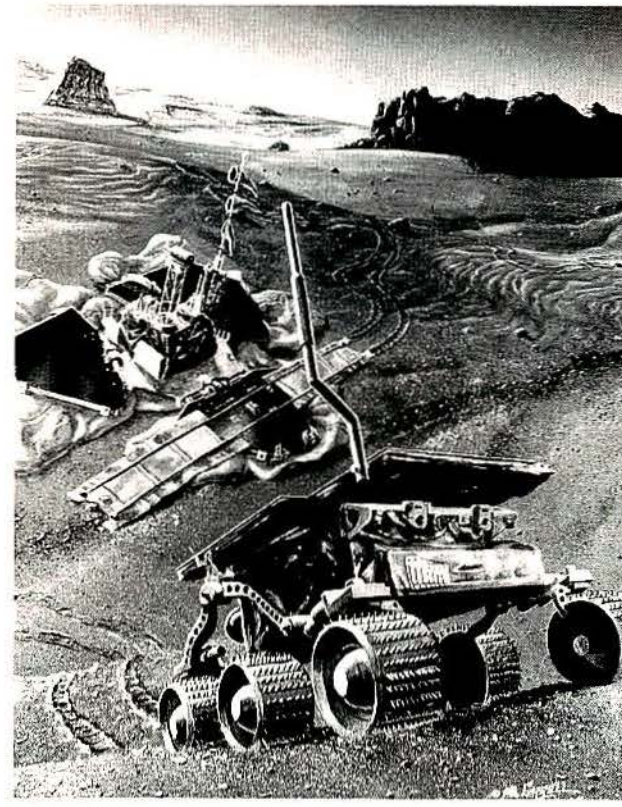


Circle (409) on Fast Fact Card

Public service portable offers 160 channels

Kenwood Communications' TK-290/TK-390 VHF/UHF portables feature 160 channels with dynamic grouping and wideband coverage. The TK-290/390 also performs in multiple-bandwidth mode, and has a dual-priority scan feature designed so agencies can monitor calls on two primary channels. The rugged die-cast chassis radio meets mil-spec 810 C, D & E standards, including the driven-rain standard, and is built with a weather-sealed universal connector for audio accessories. The radio is for public service. It features encryption control, digital ANI and emergency control options, and a recessed orange emergency key and call. Five programmable function (PF) keys enable customization for user preferences and a programmable speaker mic. For forestry, wildlife management and cooperative fire departments, an operator selectable tone/code (OST) provides a programmable bank of 16 user-selectable tones. DTMF keypad models offer manual DTMF for system access, remote control functionality and dialing features for telephone interconnect and/or PBX access.

Circle (408) on Fast Fact Card



Dataradio Wireless Data Solutions! Selected By NASA. Proven On Mars.

When NASA was looking for off-the-shelf wireless data equipment for the Mars Pathfinder mission, where did they turn? To Dataradio, the recognized leader in private wireless data. From Public Safety and Utilities to commercial applications, Dataradio's unparalleled, high quality solutions can do the trick for any of your mobile or fixed needs. No matter what the problem, we have the right solution — from the best hardware to complete system design, and just about everything in between.

Plus, we won't forget about you after the sale. Our people take pride in keeping our customers and their needs ahead of the game. State-of-the-art technology. The best radio modems and support on the market. That's the Dataradio solution. Give us a call at (770) 392-0002 and see what we can do for you or visit our website.

DATARADIO®

6160 Peachtree Dunwoody Road, Atlanta, Georgia 30328 (770) 392-0002 FAX (770) 392-9199
OUTSIDE USA: 5500 Royalmount Avenue, Suite 200, Town of Mount Royal, Quebec, Canada H4P 1H7 (514) 737-0020
World Wide Web: http://www.dataradio.com or E-mail: info@dataradio.com

Circle (63) on Fast Fact Card

Conditioner charges batteries quickly

The Pulse Analyzer Conditioner from **AdvanceTec Industries** is multifunctional and easy to operate. The battery is placed in the conditioner; no programming or buttons are needed. The battery is discharged, then charged rapidly and conditioned with negative pulse technology. The unit also analyzes the battery and displays its capacity on the digital display. The conditioner is available as a single or four-station analyzer.

Circle (410) on Fast Fact Card

Paging system works for indoor/outdoor use

Eagle Wireless International's Townpage is a compact paging system enclosed in a weatherproof housing. This system is suited for coverage infill, community paging and specialized or temporary paging systems for emergency relief systems or special events. The system includes weatherproof ruggedness, paging input capability and an economical price. The Townpage can receive paging data from TNPP inputs, TAP inputs, DID lines, end-to-end connections and wireline or modem connections. It transmits POCSAG data at 512, 1,200, or 2,400bps to numeric, tone-only or alphanumeric receivers. Flex is planned for the future. Windows 95 software is provided for control and configuration of the system. It is available in all frequencies for VHF to 900 MHz at output powers of 25W, 40W or 100W and measures 16″ × 25″ × 10″.

Circle (411) on Fast Fact Card

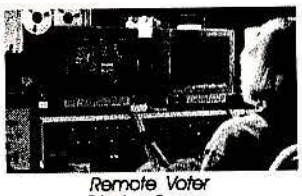
Server aids public safety agencies

Public safety agencies can chmultiprotocol server. The multiprotocol feature of the Packetcluster Patrol and Packetcluster Rescue wireless mobile information systems lets users on different radio networks communicate via one server. Departments with limited access to new and existing radio channels can use existing cellular networks to help maximize mobile information systems' capabilities without clogging their wireless networks. The multiprotocol server provides a simple migration path from a private radio system to a public wireless network. A department can enable a few patrol cars with cellular digital packet data (CDPD) prior to the entire department converting to the technology. Also, public safety vehicles regularly traveling beyond the conventional radio's range can be equipped with a mobile computer unit configured for CDPD transmission.

Circle (412) on Fast Fact Card

Attention System Engineers:

Solve Voter System Problems Fast!



Remote Voter Display Screen

Remote Comparator Display

- Control Your Voters from a Remote PC
- Cuts Costly Maintenance Time
- Finds Intermittent Problems Fast
- Reduces Receiver Downtime
- Logs Receiver Failures
- Modular & Expandable

Call or Write for our **FREE** System Planner!

Transmitter Coverage Problems?

Transmitter Steering Unit

See Us at APCO '98 Booth 2012

- Use with Multiple Transmitters to Extend System Coverage
- Automatic Transmitter Selection
- Far Lower Cost than Simulcast
- Fills Gaps in Existing Coverage
- Better than Relay-Based Controllers
- Works with Standard Base Stations

Cti Products Inc.

Land Mobile Radio Solutions

1211 West Sharon Road, Cincinnati, Ohio 45240

(513)595-5900

info@ctiproducts.com

www.ctiproducts.com/landmobile

Circle (65) on Fast Fact Card

SCEPTAR

Tone and Voice Pager

Providing Tone and Voice Pagers for over twenty years

Features:

- Synthesized, PC Programmable
- 2-Channel Operation
- Multi-Address Format
- Channel Monitoring Capability
- Vibrate Option
- Small Size—3-1/8" x 2-7/16" x 3/4"
- Single "AA" Battery
- 2-3 Year Limited Warranty Available

SCA

Shinwa Communications of America Inc.

P.O. Box 26407

Oklahoma City, OK 73126

ORDER TOLL FREE: 1-800-627-4722

FAX TOLL FREE 1-800-759-1722

Circle (66) on Fast Fact Card

Trapeze system supports 24"or 36" bridges

Valmont/Microflect's bridge trapeze system supports waveguide and/or coax runs under 24- or 36-inch bridges between the tower and radio buildings. This flexible system allows the customer to install either snap-in, cushion or "butterfly" style hangers. The system is made from hot dip galvanized steel and top quality stainless steel hardware.

Circle (413) on Fast Fact Card

CDMA/AMPS spectrum management system helps to expand network service

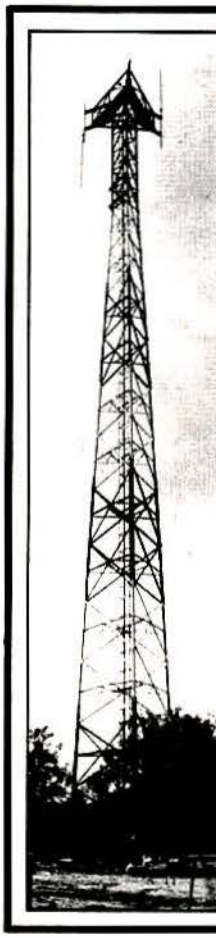
Metawave Communication's SpotLight 2000 is a dual-mode spectrum management system for CDMA, AMPS and NAMPS networks. The system uses smart antenna technology to improve the capacity of both CDMA and analog networks, providing operators with a way to expand network service before, during and after digital migration. The system provides capacity increases of more than 100% in analog networks, along with improved in-building service, enhanced call quality and expanded cellular coverage. With the integration of CDMA compatibility, the system extends the capacity and performance benefits of smart antennas to CDMA networks.

Circle (414) on Fast Fact Card

ESAS' power amplifier features five channels

Uniden PRC's ESAS come with companion five-channel repeaters and amplifiers. The power amplifier is designed for five-channel operation from a single power supply and is microprocessor-controlled, allowing for a wide input power range and power output. It also features a bar LED power indicator and alarms for low input, high input, over-temp and high VSWR conditions.

Circle (415) on Fast Fact Card



The on time, on budget tower specialists

- Custom Fabrication Facility
- Complete Turnkey Operation
- Site Preparation
- Foundations, Tower, Antenna
- Wave Guide Installations
- Guymast Analysis

TRYLON-TSF

P.O. Box 186
Elmira, Ontario N3B 2Z6
Tel: (519) 669-5421
Fax: (519) 669-8912

Circle (68) on Fast Fact Card

Receive Weather Alerts Automatically

on your 2-way radio system, PA system, voice-mail, numeric pager or telephone!

- Rack-mount and mobile systems
- Warnings digitally recorded for DTMF access and playback
- Designed specially for demanding Public Safety use

Call toll free 1-888-877-8022 or visit our Web site at: http://www.thuneagle.com

NOAA Weather Radio

THUNDER EAGLE, INC. Wireless Alerting Systems

U.S. Patents 5,444,433 - 5,574,999 - D.377,795

Circle (67) on Fast Fact Card

Dealers Wanted

TelePath is an authorized distributor for the . . .

NEW

MOTOROLA

TS10 Portable

In Stock Now
Available for Immediate Delivery

Dealers
The TS10 Portable is a Full Margin Product

Call Today
1-800-292-1700
1-510-656-5600
Authorized Motorola Distributor

TelePath
Commercial Communication Equipment

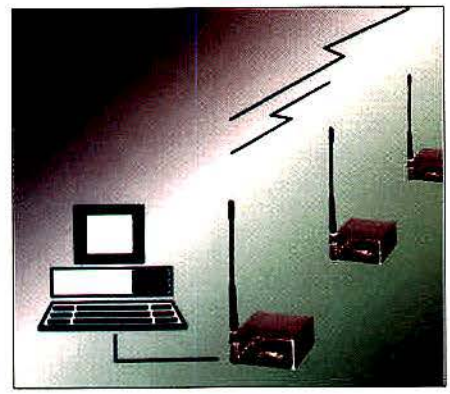
49111 Milmont Dr. • Fremont, CA 94538 • www.telepathcorp.com

Circle (69) on Fast Fact Card

Two-way portable radios feature 99 channels

Midland USA's Syn-Tech II FM two-way portables are wideband, 99-channel portable radios. Models 70-174B and 70-247B are available in 5W VHF (146–174 MHz) and 4W UHF (438–470MHz) frequency ranges. The radios have multimode narrow/wide channel operation, programmable channel bandwidth and 12.5/15kHz or 25/30kHz by channel. Also included are two-tone decode, programmable DTMF encoder and a variety of scan types geared to public safety. The portable features a 10-character alphanumeric display.

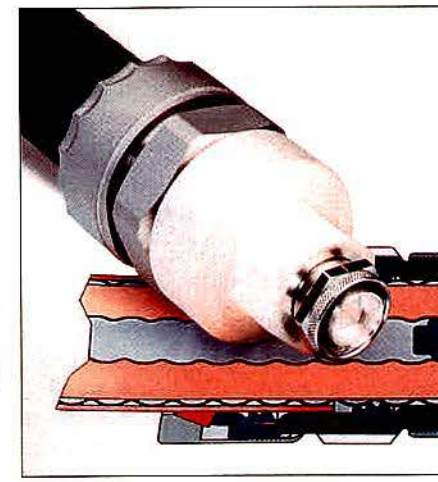
Circle (416) on Fast Fact Card



Base station communicates with local computer

RF Neulink's microprocessor-controlled base station, the Neulink 9600B, is offered in both the UHF and VHF ranges and is designed to communicate through its RS-232 port to a local computer or other intelligent host devices. The base station puts the data in a packet along with a packet identifier, a destination address and a 16-bit CRC. The packet is then sent over the air at 9,600bps to the remote network of Neulink 9600s. Over-the-air communications including error checking and correction, transmission retries, address verification and duplicate message checking are handled by the over-the-air protocol.

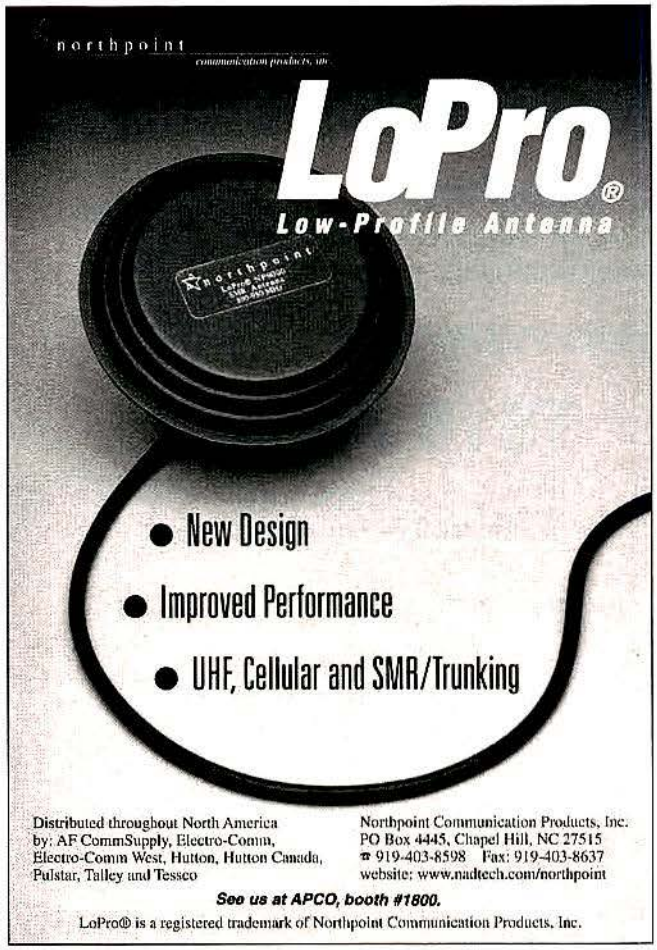
Circle (417) on Fast Fact Card



New connectors are designed for in-field installation

Huber+Suhner's Quick-fit connectors assemble quickly to 1 ¼" and 1 ⅝" corrugated cables. The two-part design attaches to the cable with no special tools, and there are no loose piece parts. The failsafe assembly of the mechanical interconnects is suitable for operator in-field installations. Available in both 7/16 and type N interfaces, the connectors feature a triple-gasket design (corrugation, jacket and center conductor) that passes the IP 68 (IEC 529) standard for moisture resistance.

Circle (418) on Fast Fact Card



Circle (71) on Fast Fact Card

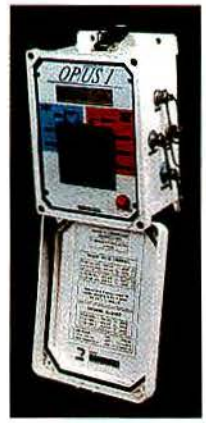
Circle (72) on Fast Fact Card

Software offers GPS fleet management system

Trimble Navigation's FleetVision 3.0 software is a GPS fleet management program based on Windows 95 and NT platforms. Designed for use with Trimble's Crosscheck AMPS cellular mobile unit and Placer family of mobile positioning sensor products, the software is an economical mobile asset management tool that helps to increase driver safety, cargo security and to improve efficiency. As seamless middleware architecture for mobile data base station applications, FleetVision is suitable for operation as a communications platform for Windows application developers and system integrators. FleetVision can also be operated as a stand-alone fleet management package. The software's multiport communications controller is flexible, simultaneously supporting wireless network protocols such as circuit switched Advanced Mobile Phone Service (AMPS) cellular, Cellular Digital Packet Data (CDPD) and Transparent. FleetVision manages two-way data messaging and voice traffic between the base and mobile units. The software includes features such as user-definable event/alarm configuration and reporting, remote control of digital output lines and simultaneous real-time.

Circle (419) on Fast Fact Card

Datalogger and controller feature on-board memory



Eagle Wireless International's OP/US Datalogger and OP/USI Controller possess on-board memory capable of storing pressure and flow data. The controller is designed to enhance production via plunger lift, intermittent gas lift and plunger assisted gas lift on gas wells and high GOR oil wells. The Datalogger retains multiple pressure, temperature and flow data. Both units are available with remote control via RF, cellular or satellite link.

Circle (420) on Fast Fact Card

Loop offers hands-free ear piece

Klein Electronics' K113 ear loop with boom microphone and in-line PTT button is for applications that require affordable, semi hands-free ear pieces. It is suitable for hotels, security staff and any radio rental fleet. The ear loop also swivels, so the user can wear it on the left or the right side of the head.

Circle (421) on Fast Fact Card

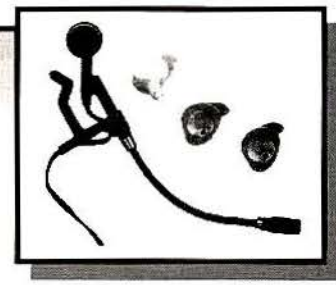
ParMarLow

LLP

Headset

-for-

Motorola - Ericsson
Kenwood - BK Radio
Uniden - Maxon – Relm
Model HD-PWH6100



-Available From-

TwitCo Distributing

PO Box 447 New Ipswich, NH 03071
Voice - 800-899-8948
Fax - 603-878-2090

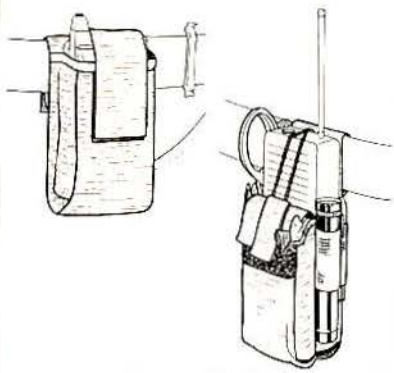
Circle (70) on Fast Fact Card

RADIO & CELL PHONE NYLON CASES

- Stylish Cases for Tough Field Use
- Competitive Prices, Profitable Sellers
- A Wide Selection for Any Need

www.raineinc.com

— DEALERS ONLY —



RAINE

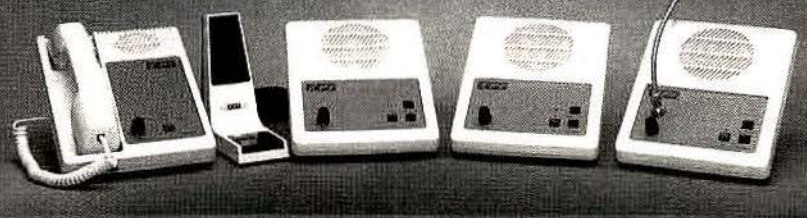
6401 South Madison Avenue
P.O. Box 4230
Anderson, Indiana 46013-0230
Tel: (765) 622-7687
Fax: (765) 622-7691

Call for a Free Catalog TODAY!

1-800-826-5354

Circle (73) on Fast Fact Card

Need Remotes?



Call us.

DC Remotes
DC Termination Panels
Tone Remotes
Tone Termination Panels
Local Extensions
Multi-Channel Remotes

941 Hensley Lane • Wylie, TX 75098
Voice (800) 869-9128 • Fax (888) 437-5360

Circle (74) on Fast Fact Card

Compact omni features modified front-to-side ratio

The DB810KRR(E)-XT from **Decibel Products** is a high-gain omnidirectional antenna with an oblong radiation pattern. It offers 13.5dBd gain in the main directions in a compact package with a flat-plate equivalent of 4 FT2. The antenna is compact because of the DB810K system combined with two reflector rods. Two aluminum rods mounted outside the antenna produce a forward-to-side ratio of 10dB. Designed for use in 806MHz–869MHz systems, this antenna offers a side-mount system for easy installation. The three-point, no-torsion mounting system prevents tilting under high-wind conditions.

Circle (422) on Fast Fact Card

Hand-held field monitor allows for choice of display

Amplifier Research's FM5501 is a portable, hand-held, single-probe E- and H- field monitoring instrument with display, control and alarm capabilities for field-related testing. The instrument accepts input from any one of eight AR isotropic probes sold to match the application and that connect to the monitor via fiber optic cable. Features include an RS-232 digital interface for remote operation; audible, user-selectable field strength; temperature, and low-battery alarms, and a graphic LCD, all of which are menu-driven and can be controlled from the front-panel or remotely. Users may choose to display readings from each axis of a three-axis probe, and a composite-axis reading simultaneously. Because the FM5501 recognizes each field probe, proper decimals and units are automatic.

Circle (423) on Fast Fact Card

Digital signal generators offer new options, waveform generator

The HP ESG-D series of digital signal generators from **Hewlett-Packard** provides a fully upgradeable, flexible signal generator to create an infinite number of signal types. Engineers can develop new systems more efficiently, test the limits of existing system components, and modify previously defined standards. The new options include the addition of CDMA and TDMA standards, a bit-error-rate (BER) analyzer and a dual-arbitrary waveform generator.

Circle (424) on Fast Fact Card

Audio
Frequency
Intersite Links
Test Sets
TX Control

land mobile simulcast overlap clarity

Simulcast Solutions

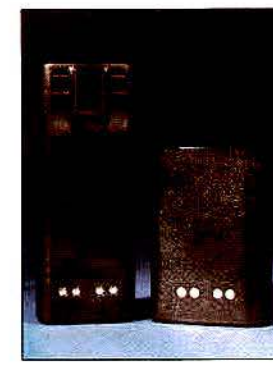
Featuring

GPS Master Oscillator

716.223.4927 TEL
716.223.3255 FAX
www.simulcastsolutions.com

Circle (56) on Fast Fact Card

Batteries carry 18-month warranty



JBRO Batteries' two NiMH batteries provide extended run time and come with an 18-month non-prorated warranty. The JB-4013 is a high-capacity NiMH battery rated at 7.5V and 2.100mAh. This is a replacement for the Motorola WPNN4013, which fits the MT2000, HT1000 and MTX8000 radios. This 6.08" × 2.35" × 0.99" new replacement is available as part number 1353. The JB-4595 NMH is rated at 7.5V and 2.200mAh. The NiMH equivalent of the JB-4595 NiCd battery fits the Saber MX1000 radio. This 4.01" × 2.93" × 1.21" replacement is available as part number 1431.

Circle (425) on Fast Fact Card

The **Complete Solution** for your Wireless **Digital Voice** and **Data Communications**

Simultaneous Voice and Data in one Channel
Two Voice Connections per RF Channel
GPS and Automatic Vehicle Location
Backwards Compatibility
TCP/IP Interface

OpenSky

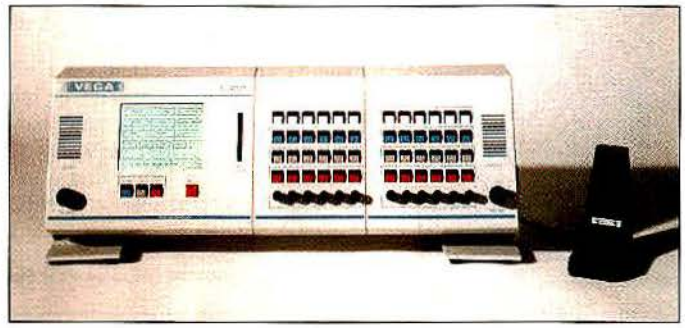
1-877-OpenSky
www.amp.com/opensky

AMP WIRELESS SYSTEMS

Circle (57) on Fast Fact Card

Console offers touch-screen control, 24-line capacity

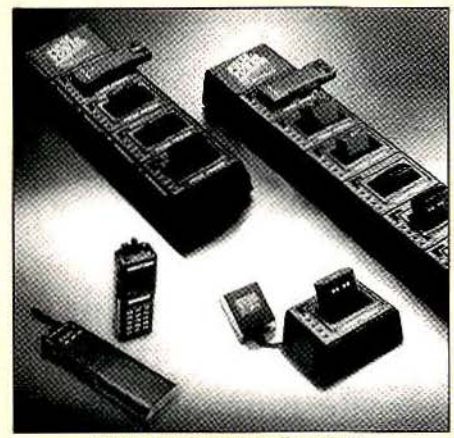
Model C-6124 radio control console from **Vega** has a touch screen and independent switches for line selection and instant PTT. It is a microprocessor-based multiline, crosspatch, desktop radio control console with a capacity to handle as many as 24 lines. Any line may be configured for either a dedicated two- or four-wire circuit, a dial-up access telephone circuit (identical to the C-550) or a full-duplex conventional PSTN telephone circuit. The flexible system offers TLM (sequential tone line modules) to allow the operator site selection for transmission, and DLM (dial-up access modules) that allow the operator to select a dial-up site for transmission.



Circle (426) on Fast Fact Card

Battery-charging system allows simultaneous charging of multiple battery types

Pulse Power's battery-charging system allows users to simultaneously charge multiple battery types on one platform. The "SM" modular battery charger features custom charging cups that match the shape, voltage and charging requirements of a variety of two-way battery models. The modular charger cups can be configured, on one platform and from one power source, to accommodate a two-way radio, cellular phone, laptop computer, camcorder, power tools, or any system using portable NiCd or NiMH batteries. The average charging time is about one hour and includes the elimination of "memory effect."

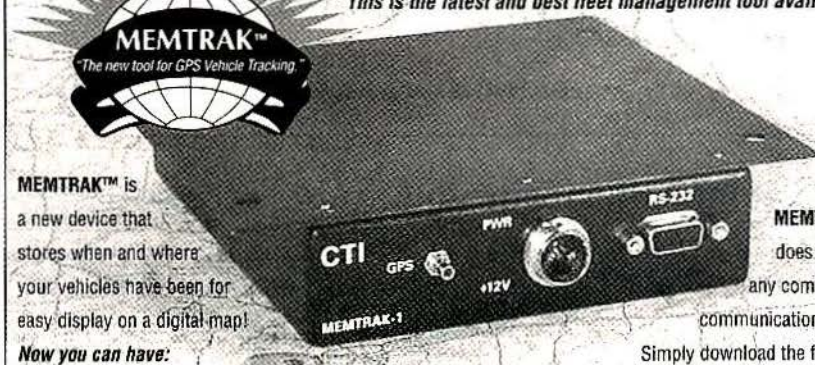


Circle (427) on Fast Fact Card

"CORP TEN INTERNATIONAL ...always a leader in GPS tracking technology."

"This is the latest and best fleet management tool available!"

MEMTRAK™ "The new tool for GPS Vehicle Tracking."



MEMTRAK™ is a new device that stores when and where your vehicles have been for easy display on a digital map!

Now you can have:

- **ACCOUNTABILITY** – See where your vehicle operators have been, when they started and stopped. Make sure deliveries have been on time!
- **SAFETY** – Monitor the speed of your drivers.

MEMTRAK™ does not use any complicated communications links. Simply download the file from the MEMTRAK™ unit every day, week or month and analyze it on our exclusive and user-friendly MEMTRAK-2000™ software.

Dealer Inquiries Welcome.

CORP TEN INTERNATIONAL · P.O. Box 20177 · Baltimore MD 21284
Ph: 410-472-4696 · Fax: 410-472-4416 · www.corpten.com · E-mail: sales@corpten.com

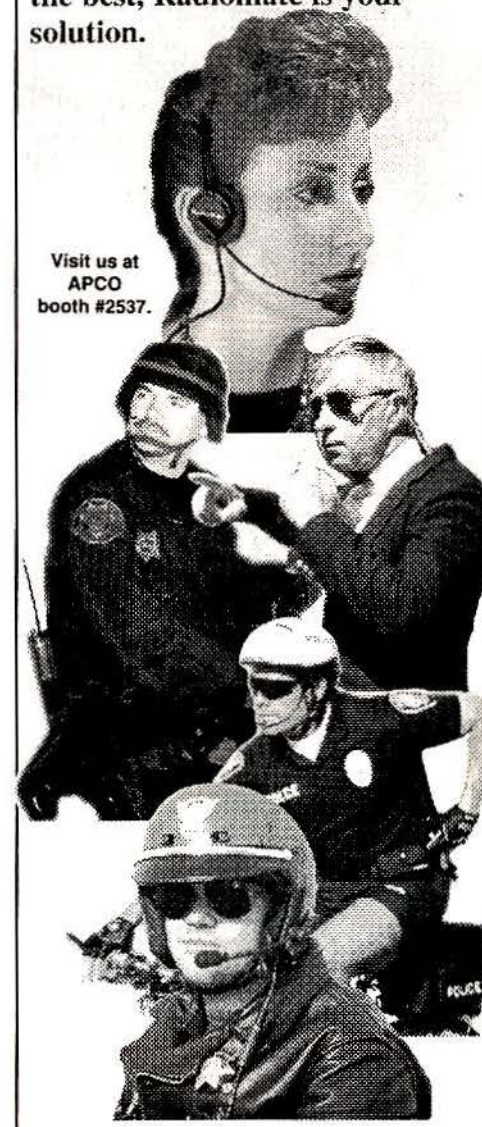
Circle (33) on Fast Fact Card

RadioMate®

HEADSETS

- ***Dispatch***
- ***Police Motorcycles***
- ***Covert/Secret Service Style***
- ***Swat***
- ***Police on bike***
- ***Construction***

We build high quality headsets for most 2-way radios, portables and mobiles. If you want only the best, Radiomate is your solution.



Visit us at APCO booth #2537.

RadioMate®

(800) 346-6442
visit our website:
www.radiomate.com

Circle (75) on Fast Fact Card

ANNOUNCING:

The Premier of the Most Important Event for the Latin American Telecommunications Industry

TelecomLatina '98
October 14-16, 1998
Miami Beach Convention Center
Miami, Florida, USA

TelecomLatina promises to be the single most important trade show for the Latin American telecom industry including both wireless and wired technologies under, one roof such as:

Cellular - Loop Access Technologies
Broadcast - Two-Way Radio & Trunking
Fiber Optics - Microwave - PCS
OSS Platforms - Satellite
Multimedia Servers - Paging - Switching
SONET & WDM - Test Equipment

Conference sessions will be held in Spanish and Portuguese and will present topics vital to the Latin American industry's needs and characteristics.

•

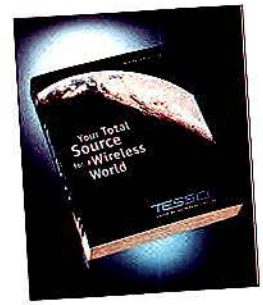
Las sesiones serán presentadas enespañol y en portugeués. ¡Esperamos verlo en Miami!
As sessões serão apresentadas em portugues e espanhol. Esperamos você em Miami!

For more information on exhibiting or attending, please call:

Tel. +1-303-220-0600
Tel. 1-800-288-8606 (US only)
Fax +1-303-770-0253
www.telecomlatina.com

Brought to you by Intertec Publishing, a Primedia Company, publishers of these leading telecommunications and related industry publications: Cellular & Mobile International, Global Telephony, World Broadcast News, Satellite Communications, Mobile Radio Technology, RF Design, Broadcast Engineering, BE Radio, Transmission & Distribution World, Fleet Owner, Sound & Video Contractor, Access Control & Security Systems Integration, Wireless Review and Telephony.
Produced and managed by the Intertec Trade Shows & Conferences division.

media



Buyer's guide produced on CD-ROM

The **Tessco** Buyer's Guide is available on a complimentary basis to all qualified service organizations. This 1,200-page source book contains more than 17,000 products from 275 manufacturers with guaranteed pricing, complete descriptions and all shipping and warranty information. This resource is also available on CD-ROM. Tessco Magic 3.0 is a total purchasing system.

Circle (451) on Fast Fact Card

Catalog features line of test instruments

Marconi Instruments' 1997/98 *Test and Measurement Catalog* features the line of test instruments for RF and microwave products. This catalog offers an updated selection of Marconi's signal sources, radio test sets and microwave and RF analyzers.

Circle (452) on Fast Fact Card

Booklet features coaxial connector information

Huber+Suhner presents the new edition of the *RF Connector Guide Booklet* featuring technical information about its line of coaxial connectors. The guide describes basic RF theory, materials and platings, connector and cable design and test measurements, including passive intermodulation. A selection of relevant formulas is also attached. The booklet can stand alone as a handy reference, but also complements the *Suhner Coaxial Connector General Catalogue*.

Circle (453) on Fast Fact Card

Web site renovated for easier-to-navigate format

Noise Com, a manufacturer and supplier of wireless test equipment, has overhauled its Web site to deliver more information in an easier-to-navigate format. Located at *www.noisecom.com*, the new site features a sophisticated, database-driven construction that allows dynamic, real-time update of information as soon as it becomes available. The new format enables customers to find technical specifications on all Noise Com test systems and components. Also available on the site are application notes, product FAQs, career opportunities and news coverage. The site is designed for viewing in Microsoft Internet Explorer and Netscape Navigator.

Circle (454) on Fast Fact Card

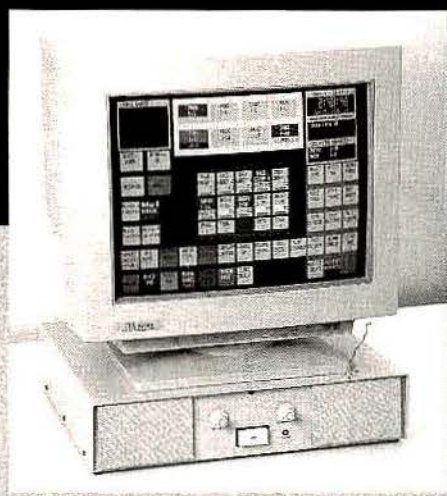
Catalog offers portable radio accessories

Earmark has released its *Accessories for Portable Radios Catalog*. The color catalog provides graphic, textual and specification information for Earmark's complete range of accessories. Learn more about how to stay in communication with tactical teams. Emphasizing multiple capabilities for in-mask operations, the catalog identifies communications accessories for both level A and level B protective equipment. The catalog shows how the ESMH aids in providing improved communications for portable radio users by providing direct access. Each headphone is vividly displayed in its own color photograph. The accompanying text details the benefits and features of each and explains the specialized task where they might be used.

Circle (455) on Fast Fact Card

DSPatch

THE WORLD'S MOST ADVANCED DIGITAL SWITCH FOR VOICE COMMUNICATIONS



Utilities, airlines, railroads, public-safety, military and other government agencies worldwide have come to rely on Avtec for advanced, high-capacity console solutions for integrated radio/telephone systems. DSPatch is a color touch-screen console system that employs Digital Signal Processors (DSP's) at every line and workstation. Its distributed architecture ensures instant responses, even in large systems. DSPatch may be configured to support from 32 to 1,024 external lines or operator workstations.

FEATURES INCLUDE:

- ♦User configurable screens
- ♦Conventional or trunked radio
- ♦ANI with call queue
- ♦Multi-format paging
- ♦Simultaneous conferences
- ♦Many more

DSPatch32, a 32-port system, is available for smaller applications.

Call, fax or write for additional information or a budgetary proposal.

Avtec

4335 Augusta Highway • Gilbert, SC 29054 USA
(803) 892-2181, FAX: (803) 892-3715
E-mail: raduncan@avtecinc.com
Web site: www.avtecinc.com

Circle (59) on Fast Fact Card

people

Wardner

Flowers

Norling

Cochran

Changes at Pyramid Communications, Huntington Beach, CA:

Paul A. Wardner, applications engineer at Standard Communications, Los Angeles, joins Pyramid Communications as director of new technology for mobile data, SCADA and OEM radio modules. **Craig Flowers,** financial analyst at Silicon Systems, Tustin, CA, joins Pyramid as production manager of manufactured products.

James Norling, member of the Newmar sales staff where he served as advertising manager, advances to marketing communications manager at Newmar, Newport Beach, CA.

Gary Cochran, after nearly five years as Midwest region sales manager for Kenwood Communications, Long Beach, CA, moves to marketing manager for Kenwood's land mobile radio products group.

Changes at Advanced Charger Technology, Atlanta:

Graydon Hansen, product development manager at AER Energy Resources, Smyrna, GA, joins ACT as director, lead acid chargers. **Cathy Hellming** departs National Data, Atlanta, as vice president, finance, to join ACT as chief financial officer.

David A. Rosi, president of EnergyVision LLC, Burlington, MA, advances to vice president, marketing for Cerulean Technology, Marlborough, MA.

Ed Muldoon moves to national sales manager at Empower Geographics, Des Plaines, IL, after leaving his position as an account executive for graphic user interface software for the IBM AS/400 at Seagull Software Systems, Chicago.

David Hatch advances to North American sales manager for Gabriel Electronics, Scarborough, ME, from his former position as sales support manager for the company.

Michael R. Fenn director, operations for National Dispatch Center, San Diego, CA, moves to executive director, operations.

Promotions at the Federal Communications Commission, Washington, DC:

Dale N. Hatfield, chief technologist for the commission, advances to chief of the commission's Office of Engineering and Technology. **Rebecca L. Dorch,** deputy chief of the competition division in the office of general counsel, moves to deputy chief of the commission's Office of Engineering and Technology.

Kevin Niemi joins Metapath Software, Jersey City, NJ, as vice president of engineering after leaving his position as senior vice president of engineering for AccessLine Technologies, Bellevue, WA.

Joel Spina moves to vice president of international sales for Repeater Technologies, Sunnyvale, CA, after leaving the same position at CommScope, Hickory, NC.

classified

MRT

Dawn Rhoden
Classified Advertising Manager

Reserve your spot in the next issue!

Phone: 913-967-1861
800-347-9375
Fax: 913-967-1735

Mail: 9800 Metcalf Ave., Overland Park, KS 66212

Category Index

Accessories	95
Computer Software	92-93
Employment	80-81
Equipment For Sale	82-92
Equipment Wanted	81
Paging	81
Professional Consulting Services	95
Professional Services	80
Rentals	92
Repair Services	94
Tower Services	95
Tower Space	95

professional services

ALCOM
David C. Allen
System Consulting & Technical Services
P.O. Box 817, Eagle, ID 83616
(208) 939-6950
davida@primenet.com

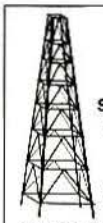
OMNICOM, Inc.
COMMUNICATIONS ENGINEERING
GENE A. BUZZI
PRESIDENT
930 THOMASVILLE ROAD, SUITE 200
TALLAHASSEE, FLORIDA 32303
PHONE: (850) 224-4451 • FAX: (850) 224-3059
E-mail: omnicom@polaris.net

FREDERICK G. GRIFFIN, P.C.
3229 Waterlick Road
Lynchburg, VA 24502
(804) 237-2044
NATIONWIDE COMMUNICATIONS CONSULTING
Mobile Radio, Microwave, E9-1-1, CAD, Paging, LAN, Dispatch Communications Centers
Multi Site Propagation Analysis

THE PORTABLE DEPOT, Inc.
KEEPING AMERICA COMMUNICATING FROM COAST TO COAST!
• FACTORY TRAINED TECHNICIANS •
• SURFACE MOUNT TECHNOLOGY •
• FACTORY APPROVED NATIONWIDE •
• EDACS & AEGIS •
• VOICE GUARD CERTIFIED •
• MPD, MPA, TPX, PCS AND ALL CURRENT PRODUCTS •
Route 2, Box 338C • Lynchburg VA 24501
ERICSSON 804-237-3427

HERB SACHS, CONSULTING
Specialist in Public Safety Communications
P.O. Box 729
Bowie, MD 20715
301-464-4268

PORTA-TECH PORTABLE TECHNICAL SERVICE, INC.
121 Crowell Lane • Lynchburg, VA 24502
GE Portable Radio Service Depot
Factory Approved Nationwide
FACTORY TRAINED TECHNICIANS FOR QUALITY SERVICE
• Current Product Lines
• Voice Guard Certified
• Public Service Trunking
• Surface Mount Technology
(804) 239-3049



LIGHTNING PREVENTION SYSTEMS
STATIC DISSIPATION SYSTEMS FOR *LIGHTNING STRIKE PREVENTION*
204B Cross Keys Rd.
Berlin, NJ 08009
Dealers/inquiries invited. (888) 667-8745
(609) 767-7209
FAX (609)767-7547
WWW.LPSNET.COM

GE PORTABLE SERVICE
• FAST TURN
• WARRANTY
• $48.00 hr./2 hr. MAX
• PARTS GE LIST
• RETURN UPS PAID
Smith Communications Service
2121 W. Parrish Ave., Owensboro, KY 42301
502-683-0936

MCCON
Mobile Communications Consulting
S.R. McConoughey, P.E.
Principal
13017 Chestnut Oak Drive
Gaithersburg, MD 20878 (301) 916-2837

TROTT
COMMUNICATIONS GROUP
RAYMOND C. TROTT, P.E.
Chairman
1425 Greenway Drive, Suite 350
Irving, Texas 75038
972/580-1911 • Fax: 972/580-0641

employment

WIRELESS SYSTEMS

SCI provides integrated solutions & on-going support to the wireless and cellular marketplace. We currently have Domestic and International projects in the following areas:

- Microwave
- Optimization/Tuning
- PCS
- GSM
- RF Systems
- Autoplex
- Propagation
- Networking
- Deployment
- CDMA/TDMA
- Domestic & Int'l Field/Customer Support
- Switch/Software/Protocol Development

For immediate consideration, email or fax your resume to:

SCI EOE
4736 Main St., Suite 7 MRT
Lisle, IL 60532
Fax: 630/960-2993
E-mail: sci@interaccess.com

Qualified, Professional Sales Representatives needed for the two-way radio industry. A prominent and leading manufacturer in the 911/Intensive Seating Industry is seeking to expand its customer base by entering the two-way radio industry. Sales Rep. organizations that have experience with console, dispatch and public safety organizations are encouraged to contact us to explore this terrific opportunity. We set the standard in the industry. If you do, then call us for immediate consideration.

CONCEPT SEATING Inc.
N76 W30500 Hwy. VV • Hartland, WI 53029
Ph: 414-966-0900 • Fax: 414-966-0909
info@conceptseating.com

RF & Microwave Engineering Job-Site™
Wireless industry employment listings
www.job-sites.com
Free for job-seekers
$100 flat fee for employers

Advertise in MRT!

employment

JACKSON ELECTRIC MEMBERSHIP CORPORATION

Jackson Electric Membership Corporation, a rapidly growing electric utility located 45 miles north of Atlanta in Jefferson, Ga., serving more than 130,000 customers, is seeking qualified applicants for the following position:

ELECTRONICS SPECIALIST

The successful candidate must have a minimum of 2 years experience in operating and maintaining an 800MHz or 900MHz trunking radio system. Additional experience in 6GHz digital microwave and 900MHz MAS radio is desirable.

This position provides technical information and expertise in electronic and maintenance of the supervisory control system, load management system, communication system, various control schemes and other apparatus untilized by **Jackson EMC.**

Qualified candidates mail their résumés, along with salary history and expectations, to:

Bill Burns, Director of Human Resources
Jackson Electric Membership Corporation
P.O. Box 38, Jefferson, GA 30549
or FAX to: (706) 367-6141

SALARY HISTORY AND EXPECTATIONS REQUIRED FOR CONSIDERATION!

Jackson EMC is an EEO/AA/V/H employer.

COMMUNICATIONS TECHNICIAN

Continuous Testing / Several Openings

County of Santa Clara (San Jose, CA) seeks individuals to service two-way radio, microwave and computer equipment used in public safety communications. Experience required, salary $3784-4582 per month, includes County contribution to the Public Employees Retirement System for the 2% at 55 Plan; and includes payment by the County of the employee's regular contribution of approximately 7%. Excellent benefits.

For an application, please contact
Communications Administration
(408) 299-2711
Equal Opportunity Employer.

TWO WAY RADIO TECH/SALES

40-year-old GROWING Multi-line Dealer with multiple facilities in Indiana, Kentucky and Arkansas has immediate need for Mobile & Portable Two-Way Technicians and Sales Staff with 2 or more years of experience on Motorola, G.E., Kenwood, Standard, LTR or similar equipment. FCC or NABER Certified. Full benefits, competitive wages, incentive bonus package, excellent working conditions and advancement opportunities.

Send resume to:
1-800-288-2430 or FAX: 1-317-248-0118
COMMUNICATIONS MAINTENANCE INC.
5601 Progress Road
Indianapolis, IN 46241
Attn: Personnel Dept.

TECHNICIAN WANTED
MOTOROLA/RELM DEALER

For installation & repair of mobile radio. Maintenance & component level repair of same. May be other duties. Required education or experience in RF technology. Will train in satellite and telephone communications. $18-$30K, depends on qualifications. Benefits include vacation & holidays. Call Paul at 701-251-6183, or email to pheer@fm-net.com. Can fax resume to 701-763-6385.

COMMUNICATIONS TECHNICIAN

Field/shop technician wanted. Must have minimum 2 years field experience and possess FCC or Naber certification. Working knowledge of mobile, portable and repeater systems preferred along with ability for component level troubleshooting and repair. Position will involve maintenance of SCADA and microwave systems. Telephone and computer network knowledge also preferred. Position will also involve work on communication towers. Salary commensurate with qualifications and experience. Excellent benefits. Please send resume to:

Rushmore Communications, Inc.
PO Box 2414, Rapid City, SD 57709
605-348-4940

Post a job opening and promote your company by advertising in the Employment section of MRT. Call Dawn Rhoden at **800-347-9375** today.

paging

Circle (100) on Fast Fact Card

Use COLOR to make your ad STAND OUT!

equipment wanted

WANTED

Syntor X/X UHF 450-470 100w
Syntors UHF 450-470 100w
Mitrecs UHF 450-470 100w
MTS2000 800MHz Flashports
or any Motorola equipment
407-253-0889

equipment for sale

• PAGERS • PAGERS • PAGERS • PAGERS • PAGERS • PAGERS •

MCMANUS COMMUNICATIONS

900MHz PURC 5000 TRANSMITTERS AVAILABLE

- Refurbished Pagers
- Factory-trained techs
- New Motorola & NEC Pagers
- Parts, accessories &

We Buy Pagers

"ONE CALL GETS IT ALL"

eXpress Xtra™
• Synthesized

MOTOROLA
Authorized Paging Distributor

400 North Fifth Street
Blytheville, Arkansas 72315
Phone: (870) 763-6250 • Fax: (870) 763-6533
E-Mail: mcmanus@arkansas.net
Web Site: www.mcmanuscomm.com

PAGERS • PAGERS • PAGERS • PAGERS • PAGERS • PAGERS

Circle (101) on Fast Fact Card

1st CLASS SERVICE: you deserve it, you'll get it.

We'll never forget you're the only reason we're here.

Sharp COMMUNICATION Distribution Center

GE

Quantity Pricing Available on:

- Mobiles
- Portables
- Conventional
- Trunked
- Accessories

radio sales to dealers only

Authorized Distributor
Mobile Communications

Paige & Tim

It's the bottom line that counts.

Distributor for:

TELEWAVE
Site Management

RFI
Connectors & Cables

SAMLEX
Power Supplies

WHELEN
Safety & Warning

WHOLESALE PRICING: 1-800-548-2484

DISCOVER NOVUS VISA MasterCard

Circle (102) on Fast Fact Card

BUY & SELL:
LTR-800MHz & 900MHz EF Johnson • Kenwood • Uniden
MOTOROLA
UHF • VHF • 800MHz • 900MHz
• Mobiles • Portables • Repeaters • Amplifiers • Paging Transmitters

1-800-786-2199

STERLING ASSOCIATES, INC.
Nationwide Purchasing and Sales of Used Two-Way Radio Equipment

203 N. Chestnut Street • McKinney, TX 75069
Fax: 972-562-7957
Mike Malone
www.usedtwoway.com

We Buy Used 2-Way Radio Equipment

SABERS

- MOT SABER IE, H44SAG7139CN, UHF, 5 WATTS, 24 FREQ., *EXCELLENT COND'N, DEC. 1993 S/NS* ..... $250 ea.
- MOT SABER II, H44SAJ7139CN, UHF 5 WATTS, 72 FREQ. ..... $340 ea.
- MOT MX300S, UHF, 5 WATTS, 24 FREQ., WITH BATT, PROM, ANT, MULTI PL .. $50 ea.
- SABER SPEAKER MICS, NMN6166 ..... $25 ea.

Personalized Service. Best Prices Guaranteed!

Call 901-755-1514
Railcom Box 38881 Radius
Germantown, TN 38183

Buy & Sell

Motorola, Uniden, E.F. Johnson, Kenwood
Two -Way Radios and Systems

DELTA COMMUNICATIONS

1-800-880-2250
FAX: 972-278-5085
Garland, TX

All CCII Labels

WHITE, ORANGE, GREEN AND RED BUTTONS AVAILABLE

$12.50 ea

CCII PROGRAMING AVAILABLE

ORDERS SHIPPED IN 14 DAYS

NORTHEASTERN *Communications, Inc.*

Waterbury, CT (203) 575-9008

EQUIPMENT FOR SALE

MOT Maxar UHF mobiles, quantity 4	$300 all
MOT Mostar 800mc, quantity 2	$200/all
MOT Maxar 80 high power UHF drawer units, quantity 6	$425/all
MOT Maratrac low band mobiles 100w 42-50mc w/acc	$325 ea
MOT Mitrex low band mobiles 100w 40-50mc w/acc	$175 ea
MOT MT500 portables low band 42-50mc	$135 ea
MOT Micor low band base stations, 100w cont. duty, tone remote	$1500 ea
MOT Pak Set low band	$200 ea
MOT Pak Rat repeaters VHF	$300 ea
MOT Micor mobiles VHF 110w w/acc	$165 ea
MOT Mitrex mobiles VHF 110w w/acc	$225 ea
MOT Maxar mobiles VHF	$110 ea
MOT MT500 portables VHF	$100 ea
MOT HT600 VHF portable, 2 freq, 5w	$155
MOT Micor 42-50mc, 100w mobiles w/acc	$165 ea
MOT Micor UHF 100w mobiles w/acc	$165 ea
MOT 1600 DC remotes	$110 ea
MOT T1600 tone remotes	$160 ea
MOT Mitrex low band mobiles, 30-40mc, 60w w/acc	$165 ea
MOT Radius UHF base station w/desk mic & ps	$295
MOT Mitrek UHF 50w mobiles, drawer units	$125 ea
MOT Mocom 70 VHF 100w mobile, 4 freq scan	$165
MOT Radius UHF mobile, 2 freq	$215
MOT Mitrek 60w, 30-40mc, drawer units	$75 ea
GE Ranger mobiles, 35-50mc, 60w, w/accessories	$295 ea
GE Ranger mobiles 100w low band 35-50mc w/acc	$375 ea
GE **RARE FIND** E Series mobiles, 110w VHF/100w UHF in same housing	$525 ea
GE MASTR II 100w UHF repeater	$2500
GE Executive II 75w UHF mobile	$260
GE Mastr II 60w mobiles, 42-50mc, w/accessories	$100 ea
GE Porta Mobile II UHF w/battery & antenna	$225
GE UHF Motorcycle radio	$325
GE PCS VHF portables	$225 ea
GE VHF vehicle repeater	$200
GE MLS UHF mobiles, NEW, 40w	$325 ea
GE PHOENIX SX UHF mobiles, brand new, in boxes	$250 ea
GE PHOENIX SX VHF mobiles	$165 ea
GE PLS UHF 16 freq portables, brand new, in boxes w/chargers	$250 ea
GE Delta mobiles, 100w, 42-50 mc, w/accessories	$225 ea
GE MASTR II 100w low band mobiles, 42-50mc, mint, meeting full factory specs. W/CG & accessories	$225 ea
GE MASTR II 100w continuous duty amplifier, 42-50mc	$550
GE MASTR II 100w continuous duty amplifier, 36-42mc	$500
GE MASTR II 44 inch cabinets	$330 ea
GE MASTR II 30 amp power supplies	$330 ea
GE MASTR II 110w mobiles w/PPL exciters, no acc	$167 ea
GE Custom MVP mobiles, VHF or UHF, w/acc	$155 ea
GE Custom MVP 42-50mc mobile, CG	$180 ea
GE Executive II VHF base station	$230
GE Executive II 30-36mc wall mount base station, CG, remote	$425
GE Executive II 100w, 8 freq mobile, 42-50mc, w/acc	$227
GE low band portables, 42-50mc, CG, w/batt & ant	$100 ea
GE Porta Mobile 48mc, with batteries & chargers	2 for $200
GE S550 Scan head	$225
GE MASTR II 100w base stations VHF	$1600
Low Band	$1800
UHF	$2000
Textronix Oscilloscope Model 475 with digital multimeter, very clean	$300
TPL RF power mobile amplifiers, 35-50mc, input 1-6w, output 80-100w	$110 ea
Astron RS-35A power supply	$125
DB Products VHF Duplexer, GE P/N 19D402955-P5	$325
Kenwood TKB-620 low band base station, brand new in box, 29.7 to 37mc	$650
General Radio 1551-C Sound Level Meter	$195
IDA controllers, tone	$85 ea
New Kenwood TK-860H 35w, UHF mobile, 32ch scan	$495
Kenwood VHF repeater, Model TKR-720	$400

Pre-Paid Orders Only • No Credit Cards, No C.O.D.s

N.H. COMMUNICATIONS CO.
P.O. Box 5342 • Manchester, NH 03108-5342
Tel: 603-668-3004

Circle (103) on Fast Fact Card

equipment for sale

BUY • SELL • TRADE • CLEAN WORKING EQUIPMENT

Bases, Repeaters, Paging TX

2-MSF 5000 800 MHz, Rptr C65CXB-7106	CALL!
6-SyntorX 800 MHz Base Consolet	CALL!
20-GE 900 MHz-PRC-8/9 45W Repeaters & Digital Paging Station	Call
10-900 MHz Paging Tx Mot, GE, Granger	Call
20-Mastr II-E 75W UHF Mobile Repeaters w/ Duplexer	From $395
10-MICOR 800 MHz Repeaters 125W	From $1000
50-Micor Base/Repeaters 100-375 Watt Low or VHF	Call
1-MSF-5000 UHF Repeater 100 Watt, NEW 402-420 MHz	Call
4-MSR 2000 Base/Paging TX C74GRB & C73KSB Rptr	Call
20-Mastr II Base/Repeaters 60-250 Watt All Bands	Call
20-Mitrek Base 100 Watt All Bands	Call
25-Aerotron Pioneer 1000 VHF Repeaters ACSB	Call

Mobiles 25-50 MHz

1-Uniden FTL 1100C 100 Watt, R/M	$250
1-Patriot, 35-50 MHz, 60 Watt 8 Ch.	NEW $250
200-Mitrek 30-39 MHz 100 Watt	From $200
10-Mitrek 39-50 MHz 110 Watt 4 Ch	From $200
20-Mitrek 30-39 MHz 60 Watt	From $100
300-Mitrek 39-50 MHz 60 Watt	From $50
10-Syntor X 30-50 MHz 100 Watt	Call
1-Marstrac 42-50 MHz, 8 Ch, 110 Watt	From $395
20-Delta 36-42/42-50 MHz 100 Watt	From $100
200 Mast II 30-50 MHz 60-100 Watt	From $50
10-Midland 70-056B 100 Watt R/M, 36-42 MHz	$195

Mobiles 150-175 MHz

30-Mitrek 45-80 Watt 4 Ch.	From $50
4-P200 2-8 Ch, 5 Watt,	Call
6-Midland 70-480 B R/M	$200
50-Syntor X 110 Watt 32 Ch	From $200
30-Micor 45-100 Watt 4 Ch	From $50
20-Mastr II 80-100 Watt 8 Ch	From $50
30-MVP 35 Watt Mobile/Repeater	From $50
20-Delta S 100 Watt	From $100
50-PAC-RT 1.5 Watt Mobile Repeater	From $100
200-Aerotron Pioneer 2000 ACSB	Call

UHF Mobiles 450-470 MHz

4-Ranger 50Watt	From $200
20-Syntor X T34VBJ 32 Ch 40W	From $100
20-System 9000 PAC-RT 4KEA300GA	From $495
50-Mastr II 45-100 Watt Repeater Builders	From $100
15-Mot PAC-RT Mobile Repeaters	From $200
30-Mitrek T44JJA 50 Watt	From $100
20-HT600 & HT1000 Portables UHF 2-16 Ch	Call

800 MHz Mobiles

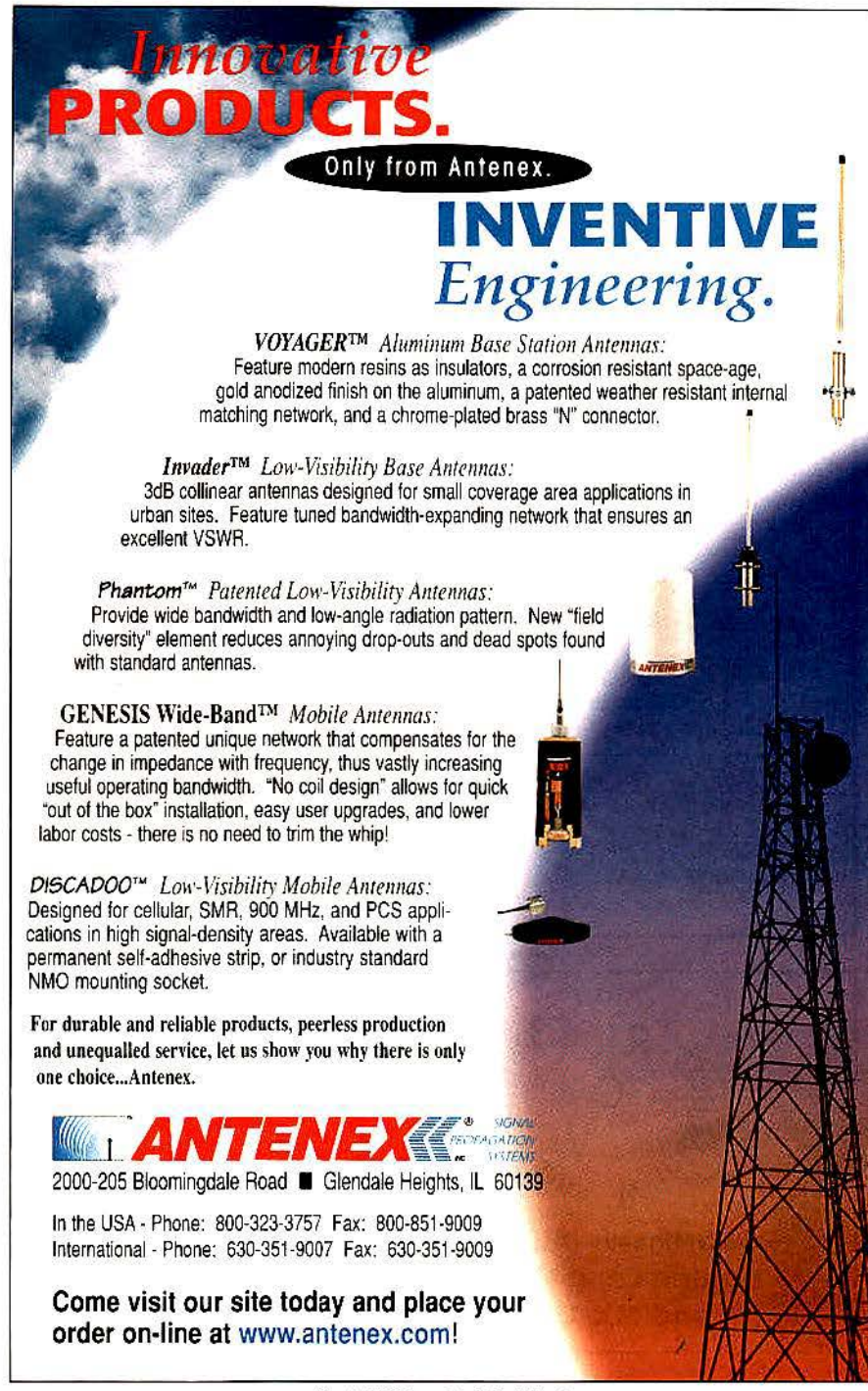
20-Syntor X 9000, 35 Watt	Call
6-MTX 800 Classic 16 Mode & 810	Call
6-MTX 8000 16 Mode & 590 Smartnet	Call
10-Spectra T45KGA55JC9AK 1&2 SmartNet w/ VRS & Siren	Call
8-Spectra D45KMA7JA5AK	Call
50-Maxtrac 800T 15-35 Watt B-1-B-7	From $150
5-STX SmartNet 1 & 2 H35WKA5175AN	Call
4-GE MDX 800 PM 825N	Call
30-Syntor X T45VBJ 35 Watt Dual/Mode	From $100
3-Ranger 800 144-AZ	Call
20-Spectra 900/87	Call
20-EX II 35 Watt W/M II PA	From $100
100-Mostangs, Micors, Traxars, Midland, TAC, TEC, GE	From $25

Misc Items

1-R 2001 B Serv. Mon. Good Condition	$2995
50-Uniden, Converta/Com APX0839/APX15TS	Call
3-GE/Panasonic TQ 2310 Programmer	From $500
40-Centracom II Control Eq, Consoles BIM, CEB, Panels, Cabinets	Call
2-Centracom I Consoles & Lots of Parts	Call
30-SpectraTac Voter Rec Comparators	Call
20-GE Voter Receiver & Voter Panels	Call
500-MOT & GE Tone & DC Remotes All Types	Call

BARNETT ELECTRONICS INC.
330 HWY 236 W., Leneke, AR 72086
ORDERS & BIDS: 800-423-3858 FAX: 501-676-2475
For Expanded List, updated weekly, look at our Website: www.barnettelec.com
Info: 501-676-5506
VISA & MC Accepted, NO COD's

Circle (104) on Fast Fact Card



Circle (105) on Fast Fact Card

SAVE BIG BUCKS ON
Used 2 Way Radio
MOTOROLA • GE • EF JOHNSON etc.
PORTABLES / PAGERS / MOBILES / BASES / REPEATERS

Contact us when you are looking for economical used equipment. We are a reliable source for all major brands of used 2 way gear

(708) 681-0300
Buy • Sell • Trade

Visit our web site: WWW.MDMRADIO.COM
or E-Mail us at mdmradio@earthlink.net

MDM Radio Ltd.
1629 N. 31st Ave. Melrose Park, Il. 60160
Tel. (708) 681-0300 Fax (708) 681-9800

Invest your advertising dollars where your prospects invest their time...

MRT™

classified

equipment for sale

MOTOROLA RADIOS

RADIUS — RADIUS — RADIUS
Tons in stock at USA's lowest prices
SP50—P110—GP300—SM50—SM120—M120—GM300
will absolutely be SHIPPED TODAY!

Full line of previously owned trunked & conventional radios
HT600/VISAR/HT1000/MT2000/MARATRACS/
TRUNKED 800 & 900 SPECTRAS/MAXTRACS/
PP1000X/MTX/MTX8000/VISAR/STX/EXPO

RADIO EXPRESS INC.
OFC: 800-545-7748 FAX: 703-830-8710
e-mail: radios4sale@juno.com
All major credit cards accepted

Circle (106) on Fast Fact Card

Programmers for most common models of
ICOM KENWOOD uniden

$99.00 each

Switching Power Supply by Samlex
SEC-1223
25 Amps.
$79.00

Upgrade Your Service Shop !!!
- Immediate Delivery
- Complete with Programming Harness
- Requires a P.C.

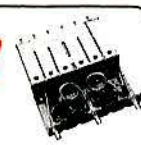
Light Towers at a low Price
Rugged Galvanized Steel

10ft. long X 12"wide tower section (assemble up to 50ft. in height) $33.00each
10ft. long X 17"wide tower section (assemble up to 80ft. in height) $72.00each.

High Quality

BASES, TOP SECTIONS AND OTHER ACCESSORIES AVAILABLE !

The Highest Quality Duplexers in The World !!!
VHF or UHF any Subbands.
Now Improved with **Silver Coated** Elements
for Higher Isolation and Better Temperature-Stability.
Dealer Price $179.00



EPCOM
The Biggest Warehouse in U.S.A.
www.epcom.net
1630 Paisano Dr. El Paso, Tx. 79901
(915) 533-5119 Fax (915) 542-4701
Ask For Your Free Catalog

Circle (107) on Fast Fact Card

Radio Communications Wholesalers RCW

We Nationally Distribute
Uniden Land Mobile and MX-COM

Check out our Web specials!
www.radiocomm.com

- We have a **Flat Rate Repair** service.
- We do **Installations** of MX-COM boards.
- Wholesale Prices to **Dealers Only**.
- We carry a wide selection of both radios and accessories for your convenience. Shop at just one place rather than ten for all your communications needs.

800-726-9015 • 612-808-0069
fax: 612-808-0087
email: sales@radiocomm.com

Circle (108) on Fast Fact Card

• BUY • SELL • TRADE •

• BOARDS • STRIPS • ACCESSORIES • ELEMENTS • REEDS •

PCI — PEKAAR COMMUNICATION INC.
$ Specials of the month $ *Steve's back, formerly of Gregory Electronics Corp.*

GE MLS mobiles 150–170 range w/accessories	$175
GE MPD portable w/accessories, band 150–170 range w/voiceguard	$225
GE DELTA S or SX Mobile—110w, hi-band, 150–170 range w/accessories	$200
GE MPS Portables synthesized version of MPX high band with battery	$65
GE MVS mobiles hi-band with mic & bracket	$175
GE MARC V SAM trunked repeater 800 MHz range, less duplexer & cabinet	$750
GE PHOENIX Mobile NSHH1W40TB—Hi-band dual priority scan/grey case with accessories	$200 ea.
GE PCS portable hi-band 150-170 range w/scan	$225
GE MASTR II 100w mobile, 36-42 range w/accessories	$50
GE MPI-1 portable UHF 4 watt with antenna, FREE rack charger with purchase of 6 portables	$35
GE TMX 8310 mobiles 800 MHz range w/accessories	$65
GE CMX 8630 mobiles 800 MHz range w/accessories	$65
Ericsson GE MDS mobiles comb. TL800, 800MHz range w/accessories	$125

Catalog Available **If you can't find it, try us!** **Call (973) 772-0704**

• BOARDS • STRIPS • ACCESSORIES • ELEMENTS • REEDS •

• BUY • SELL • TRADE •

CMC ENTERPRISES
2-WAY, MICROWAVE & TELECOM EQPT.

Quantity	Equipment List	Price
09	Motorola 800Mhz Repeaters (Conventional) Micor very good condn	$1600 ea O
08	Motorola Starpoint 2.1-2.3 GHz radios w/hot stand-by	$1800 ea O
12	Motorola Maratrac A2 UHF 110w w/accessories	$375 ea O
12	Fannon FL 1-66 GHz radios w/hot stand-by, very good condn	$2500 ea O
15	Motorola Syntor X 9000 UHF 110w w/accessories	$400 ea O
01	Scientific-Atlanta 4653a BERTS transmitter (DS1/1C/2)	$1000 ea
01	Scientific-Atlanta 4654a BERTS receiver (DS1/1C/2)	$1200 ea
200	Motorola Mitrek 30-39 60w w/accessories	$125 ea
08	Motorola Micor Base 110w 36-42	$500 ea
20	Ericsson-GE MDS-TL800	$160 ea
25	Johnson 8604 LTR	$140 ea
14	Johnson UHF 5963 with charger	$100 ea
80	GE TMX 8615 G-mark	$125 ea
04	GE Delta S 100w UHF with accessories	$175 ea
05	Motorola L44BCB	$150 ea
05	Motorola Micor Base station High Band 80w	$500 ea
10	Motorola Maxtrac 800 B-1	$175 ea
08	Motorola MTX 8000 B-3	$250 ea
06	Motorola MTX 800 single system	$175 ea
20	Motorola MTX 810/classic multi-system multi-subfleet	$225 ea
10	Motorola Maxtrac 800 B-3/6	$200 ea
05	Motorola Visars 800 mhz	$225 ea
05	Linkurt 77BF2 1.7-1.99 with hot stand-by	$1000 ea
80	Granger DTL 7300 Channel modems with E&M Signaling	$125 ea
25	ADC jackfields with plug type rear connections	$100 ea
03	Larse 1242A alarm panels	$100 ea
30	MC-400 Channel modems	$80 ea
06	ITT A326 6ghz with hot stand-by	$1000 ea
08	Fannon FL 1-2 1.7-1.9ghz (non stand-by $600) with stand-by	$1000 ea
1000	Assorted Tellabs telcom signaling modules	$ CALL $
75	GTE Linkurt 46A channel modems	$100 ea
80	Rockwell channel modems	$100 ea
30	DTL-7300 shelves (add-on $125) start-up	$150 ea
50	MC-400 Term cards	$50 ea
01	Dictaphone 5500 20 channel logging recorder	$1000
50	Motorola Mitrek 42-50 PL 60w	$125 ea
30	GE Master II 110w 42-50 with accessories	$80 ea

O New Listings O
Call Charles or James at: 336-769-2885

www.usedradio.net
(Equipment list, prices & order capability all on the Web)
Motorola-Maxon-Kenwood
Portables ★ Base Stations ★ Mobiles
SP10/P110/GP300/M120/GM300
SP2550/SL500/CPO510
ETC.
Close-out Pricing!
American Radio Exchange
Ofc: 888.260.7368
Fax: 310.312.5437

CHANNEL ELEMENTS
YOUR FREQ. - $20.00
with trade-in/3 working days
CRYSTALS
MAXON, TEKK, UNIDEN/7working days
Channel Element HQ/Kirby Ent.
4120 Kirby Rd. Cincinnati, OH 45223
1-800-237-9654
FAX: 513/542-8870

Take note:
MRT Classifieds work!

equipment for sale

We like, sell stuff.

GENUINE WHOLESALE

K-111

- The perfect Customer Service accessory, this 2-piece microphone is lightweight and offers superior audio clarity.
- Mic. has clothing clip and PTT button on it's side.
- Earbud comes complete with an extra foam earcover.
- Made for Motorola, Kenwood, Standard, Vertex, etc...

K-115

- This microphone kit is complete with a very good quality, lightweight boom microphone and the most comfortable earloop available.
- Earbud has replaceable foam ear cover.
- In-line PTT button is complete with clothing clip.
- Made for Motorola, Kenwood, Standard, Vertex, etc...

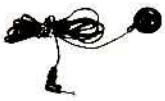
K-9725

- Manufactured to work on the Motorola Radius" line, this heavy-duty remote speaker mic. has excellent audio quality.
- Full warranty and wholesale pricing make this remote mic. a must have.

K-200

- Super-high quality single or dual muff headset for high-noise environments. Voted "Best in Class".
- Noise cancelling electret microphone.
- PTT button on earshell.
- Comfortable earcushions.
- Adjustable headband.

K-100



- High Audio Earbud.
- 2.5mm or 3.5mm connectors available.
- Works on radio or with other accessories.
- Extra foam ear cover included free.

Klein electronics

"WE are in business to increase YOUR business"

CALL NOW! (800) 959-2899

Fax your order to: (760) 631-1163

Web Site: www.kleinelectronics.com e-mail: info@kleinelectronics.com

Circle (109) on Fast Fact Card

USED EQUIP for sale

www.mosscom.com

CRYSTALS

7 day delivery/$6.00

888-678-9825 ph.

915-633-6209 fax

CUEMEKS ELECTRONICS

BUYING ERICSSON-GE EQUIPMENT
CALL OR FAX FOR QUOTE

MASTR III Station Modules	CALL
PD 638-6 VHF Duplexers	65
TQ3380 IPE/DPE 200 Program kit Factory net $4000 new on sale	400
S825 Systems Control head	200
S990 128ch head w/warranty	125
MVS MPH20 VHF 16ch scan w/acc	275
PHOENIX-SX 16ch non-scan	165
PHOENIX-SX UHF BRAND NEW w/acc	225
MLSL160 30-42 w/acc., new	285
MLSL261 42-50 8ch w/acc.	275
MTL UHF 4w Portable w/charger	225
MPI UHF 4w tech. special	5/100
MPI 8-unit multicharger, checked	40
RANGR 150-174 less acc. 100w	395
RANGR 450-470 less acc. 100w	325
RANGR 35-50 less acc. 60w	250
RANGR/Delta acc. w/S600 head	165
Delta-SX VHF 110w less acc.	275
Delta-S VHF 110w less acc.	250
Delta-S 42-50 less acc. 110w	135
Delta-S 42-50 less acc. 60w	100
MVS Control panel 16ch scan	40
MLS-I Control panel 8ch scan	40
MLS-I Control panel 16ch no scan	40
MPA/MPD/PCS/MRK Speaker mic.	35
MASTR II 42-50 110w less acc.	125
MASTR II 150-174 110w no acc.	115
MPS/MPR/MPX/MPI/MPE Chargers	CALL

NEW LONDON TECHNOLOGY
752 Alum Springs Road • Forest, VA 24551
Tel: 804-525-0068 • Fax: 804-525-0078
www.newlondontech.com

Handheld Repeater Controller

Convert any handheld or mobile radio into a simplex or duplex repeater system. Ideal for setting up short-term emergency service repeaters at remote locations or disaster sites.

www.spectrum-usa.com
SPECTRUM Phone: 800-566-2788

USED RADIOS
at Low Prices!

• MICOR	• GE
• MITREK	• RCA
• PORTABLES	• ACCESSORIES
• MOCOM 70	• TONE ELEMENTS
• MAXAR	• CHRYSTAL ELEM.
• RPTRS	• BASE STATIONS

Large Quantities • (940) 433-5452

SELLING MDI SYSTEM

MDI-9031 Mobile Data Terminals
MDI-8100 800 MHz Radio Units
MDI-2031 Base Station Controllers
MDI-2100 Base Station Controllers
MDI-5031 Multi Channel Processor
MDI-4031 Communications Controllers
Miscellaneous Parts & Accessories

For a complete list
Email: jemery@michcon.com
Fax: (616) 235-4112

$ Sell it *FAST!* in MRT Classifieds

USE *MRT* CLASSIFIEDS!

equipment for sale

Monitor your Tower Site from your Desktop!

AR2™

AR2, by Xcel, is an automated monitoring system that keeps you updated on the status of your tower site and lighting.

AR2 gets information from 32 user defined inputs, plus lighting inputs, and logs a database of the last 500 events. An alarm is instantly reported to 5 faxes (listing all information required by the FAA), and sends numerical data to 5 pagers. Other devices can be controlled with 8 users defined outputs.

The AR2 system can turn on your tower lights if your photocell fails, then notify you!

With a P.C. you can connect to the AR2 unit from a remote location and get real-time status of your site, download the event database, troubleshoot, and control other systems, such as HVAC and security.

Call toll free
1.800.288.7362

Fax
1.219.259.5769

Internauts connect to
http://www.xcel.com

Xcel Controls, Inc. - 1600 W. 6th St. - Mishawaka, IN 46544

Circle (110) on Fast Fact Card

Looking for a replacement for your Plectron receiver?

Look no further than the ALERT by REACH.

- Over 2 Watts Audio
- RSO
- Tone/Monitor Capabilities

Reach® **1-800-445-0007**
Pagers also available

Used Equipment for Sale

Sutter Buttes 2-Way, Inc.

921-A N. George Washington Blvd.
Yuba City, CA 95993 USA

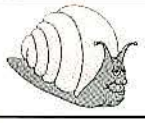
T: 530-674-7532
F: 530-674-1941
http://www.2-way.com
email: sales@2-way.com

VISA MasterCard

7	Midland VHF 70-482B 110w remote mount w/o acc	$175
1	Midland 70-665D/70-480B VHF w/o acc	$175
4	Midland 70-050C LB 60w 42-50 w/o acc	$99
2	Midland 70-1442B VHF w/o acc	$150
1	Midland 70-1632B/ 70-1530B w/o acc	$175
3	Uniden SMS 935TS 900MHz LTR mobile	$175
29	Uniden SMS 930TS 900MHz LTR mobile	$175
30	Uniden SMS 825 TS 800MHZ LTR mobile	$149
20	Uniden SMS 310 TS 800MHz LTR portable	$149
30	Kenwood TK-930 800MHz LTR mobile	$149
20	Kenwood TK-940 800MHz LTR mobile	$149
20	Kenwood TK-480 800MHz LTR portable	$195
100	Kenwood Programming cable for all PC programmable mobiles	$75
50	Motorola Maxtrac 800MHz 2 Sys LTR	$149
50	Motorola Maxtrac 800MHz B1/B5/B7	$CALL
73	Motorola Maxtrac 900MHz D37MQA5GB2AAK 2/sys trunked	$195
7	Motorola Maxtrac 900MHz D37MWA5GB7AK 10/ sys trunked/conv	$295
6	Motorola Maxtrac 100 800Conv D35MJA73A5CK 2F 15w	$175
2	Motorola Radius 800MHz conv D35LRA77A5AK	$175
30	Motorola MX 350S 4F/8F UHF 4w	$75
40	Motorola Syntor T44SRA3900AK UHF w/o acc. radio only	$99
200	Motorola Micor T44RTA1900BA UHF w/o acc. radio only	$49
15	Motorola MTX LS 800 LTR portable H01UCC6DU3ANNX	$375
25	Motorola MTX-8000 H01UCC6DB3AN, 16 sys	$275
20	Motorola MTX 800 1 sys/ multi sys / classic H25JBF51B1AN	$CALL
30	Motorola STX Type 1 800MHz 1 sys / multi sys H35JNC5170CN	$CALL
400	Motorola STX 821 Smartnet Type 2 800MHz H35WPA5170DN w/batt. ant & chrgr	$895
30	Motorola HT-600 UHF 2F/6F 4w w/rapid	$275
25	Motorola HT-600 VHF 2F 5w w/rapid	$275
5	Motorola Visar 800MHz H05UC6CB1AN trunked	$275
20	Motorola Micor C73RXB3106BT 110w VHF repeater DVP PL (NEW in box) NOS	$CALL
5	Motorola Micor C71RCB3105DT 42-50 100w repeater	$1995
8	Motorola Micor UHF C64RCB3105A 75w PL single user repeater	$1295
12	Motorola Micor 100w 42-50 DC base (unified chasis)	$750
2	Motorola Micor 72 MHz base station DC control	$1495
26	Motorola T1605 Tone Remote w/desk mic NEW	$249
14	Motorola M.R.T.1 telephone interconnect L1159A NEW	$249
8	Motorola T-1617 2f \ 4f consoles	$199
4	Motorola 43 MHz Micor Purc Base C71JZB-1106A	$1995
8	GE Mastr II 100w 42-50 base DC	$850
1	GE Mastr II UHF 75w repeater	$1695
2	GE Mastr II UHF 40w repeater	$1295
9	CellWave 505980 4ch 851-960 TX combiner, will tune	$995
13	Avantek Digital 2GHz microwave w/mux 4 complete hops 2w/hot stanby	make offer
3	Dictaphone 4000, 5000, 9000 logging recorders	$CALL
	Lots of Motorola Centracom I & II parts furniture & cebs	$CALL

All equipment is "as is" and untested unless stated

Circle (111) on Fast Fact Card



Don't delay!

Get your ad in the next available issue!
Call Dawn Rhoden TODAY for details:
800-347-9375

NEXTEL DEALERS

$2.50 ea.

ip370 case with swivel
closeout special
718-783-6000

FOR SALE MOTOROLA R-2038/D/HS SERVICE MONITORS

FREQ. RANGE 1MHz TO 1GHz, SPECTRUM ANALYZER, DUPLEX GENERATOR, SWEEP MULTIMODE CODE SYNTHESIZER, CELLULAR

ASKING PRICE $5900 EA.
5 UNITS AVAILABLE

RF IMAGING & COMMUNICATIONS
925-229-2034 FAX: 925-229-2035
http://www.best.com/~rfimage
e-mail: rfimage@best.com

WHY PAY MORE

Air Comm Furnishes Quality—Price—Selection—Satisfaction

SAVE THIS AD

NEW OLD STOCK (N.O.S.) RADIOS (1995/96):

MOT GP300 VHF 5W 2F 12.5KHz W/ACCY	$300
MOT GP300 VHF 5W 16F 12.5KHz W/ACCY	350
MOT GP300 UHF 4W 2F 12.5KHz W/ACCY	300
MOT P110 VHF 5W 6F 12.5KHz W/ACCY	300
MOT P110 VHF 5W 2F 12.5KHz W/ACCY	275
MOT P110 VHF 2W 2F 30KHz W/ACCY	235
MOT HT1000 VHF 5W 2F W/ACCY (H01JDC9AA1)	425
MOT HT1000 UHF 4W 16F W/ACCY (H01SDC9AA3)	575
MOT MTX-8000 800MHz TRUNK B3 W/ACCY	300
MOT VISAR 800MHZ TRNK B1 RADIO ONLY	200
MOT MAXTRAC 800MHz TRUNK 15W B5 W/ACCY	225
MOT P50 UHF 4W 2F MX COM PL/SCRAMBLER	175
UNIDEN UHF 4W 16F PORT W/DIG DISPLAY (FTU454) W/ACCY	275
EFJ 8565-501 800MHz 1.0W PORT W/CHARGER	125
EFJ 8565-502 800MHz 2.5W PORT W/CHARGER	125
EFJ 8150-201 800MHz VIKING CX-HL81 RADIO ONLY	125
EFJ 8180-201 800MHz AVENGER SI-HL83 RADIO ONLY	150
EFJ AVENGER 465-500MHz 25W 99F 12.5KHz MOB RADIO	150
EFJ 8600/8605 800MHz TRUNK 15W W/ACCY (NOT BOXED)	225
E/GE EDACS CONSOL BASE 800MHz TRUNK W/RANGER RADIO	375
E/GE EDACS CONSOL BASE 800MHz TRNK W/O RADIO (N8D105)	100
E/GE PHOENIX SERIES 120/220VAC 12VDC P.S. (19D430225G1)	25
ANTENEX VHF 3db BASE ANTENNA FG1523 152-156MHz	75
NEXTEL IP280 P/N H07UBH6QR3AN (PHONE ONLY)	175
MOT 'SABER' MOB.VEH.ADPTR (MVA)-NOT SYSTEM SABER COMPATIBLE	275
MOV 'HY600/MT1000' MVA	250

RECENT ARRIVALS:

MOT MSR-2000 470-495MHz 90W PL RPTR W/DPLXR	$2000
MOT MSR-2000 450-470MHz 90W BASE W/12VDC P.S	1500
MOT MSR-2000 450-470MHz 2W PL BASE W/12VDC P.S	900
MOT SYNTOR-X9000 CONV CONTROL HD 8K 64F (SIM. TO HCN1073)	100
MOT SYNTOR-X9000 CONV. CONTROL HD AS ABOVE (NEED REPAIR)	50
MOT MICOR VHF/UHF 250W PL DC REM RPTR (NEED PA TUBES)	1000
MOT MARTI MODEL L1158/1159 INTERCONNECT	200
MOT MARTI 1000 INTERCONNECT	275
MOT MARTI 2000 INTERCONNECT	325
MOT P100 VHF 5W 2F W/ANTENNA ONLY	160
MOT P100 UHF 4W 2F W/ANTENNA ONLY	160
MOT GP300 UHF 4W 2F W/O BATTERY	275
MOT P110 UHF 4W 2F 12.5KHz W/O BATTERY	250
MOT SP50 UHF 4W 10F W/RAPID CHARGER	300
MOT SP50 UHF 4W 2F W/RAPID CHARGER	265
MOT SP50 VHF 5W 10F W/RAPID CHARGER	265
MOT P200 UHF 2W W/ANTENNA ONLY	175
MOT HT600 UHF 2W 6F W/ANTENNA ONLY	200
MOT DARCOM 9000 900MHz T/R	450
MOT MAXTRAC 100 UHF 40W 2F	275
MOT MT1000 42-50MHz 6W 6F W/ANTENNA ONLY	285
MOT M100 UHF 40W 2F	250
MOT SM50 UHF 25W 2F	220
MOT MAXTRAC 60W 2F 42-50MHz	300
MOT SYNTOR.X 100W VHF 8F W/ACCY	350
MOT HT600/MT1000 MOB VDH ADPTR	175
E/GE MASTER II VHF 110W C/SQ MOB RADIO ONLY W/O TCXO	60
E/GE MLS II 60W 42-50MHz 2F	250
WACOM DUPLEXER UHF B/P-RJT W/NOTCH P/N WP678-578-2	400
WACOM DUPLEXER VHF B/P-RJT 600KHz P/N WP639	CALL
WACOM DUPLEXER VHF B/P P/N WP-28-37-09	350
CELWAVE DUPLEXER VHF P/N636-6-1	200
UNIDEN UHF RPTR 25W	CALL
NEXTEL I370 P/N H07UBH6NRTAN W/CHARGER	150
NEXTEL R370 RAVEN H13UAH6RR5BN W/CHARGER	175
NEXTEL MOBILE M02UCH6RRAN	200
NEXTEL LINGO P/N H02UCH6RR8BN	175

PORTABLE RADIO ACCESSORIES:	**W/RADIO PURCH**	**W/O RADIO PURCH**
MOT HT1000 1-HR CHARGER	30	40
MOT HT1000 10-HR CHARGER	15	20
MOT HT1000 ENHANCED CHARGER	55	(NEW) 65
MOT HT1000 REMOTE SPEAKER MIC	35	40
MOT GP300/P110 SERIES 1-HR CHARGER	30	40
MOT GP300/P110 SERIES 10-HR CHARGER		(NEW) 20
MOT GP300/P110 SERIES REMOTE SPEAKER MIC	35	40
MOT GP300/P110 SERIES 6-UNIT AC PS ONLY		(NEW) 125
MOT HT600/P200 1-HR CHARGER	30	40
MOT HT600/P200 COMPACT CHARGER	10	(NEW) 20
MOT HT600/P200 6-UNIT RAPID CHARGER	175	200
MOT HT600/P200 REMOTE SPEAKER MIC	30	40
MOT HT600/P200 CARRY CASE W/SWIVEL		(NEW) 35
MOT HT600/P200 3" BELT CLIP	5	7
MOT P100/HT90 1-HR CHARGER	25	35
MOT P100/HT90 COMPACT CHARGER	10	12
MOT VISAR 2-UNIT RAPID CHARGER	65	N/A
MOT SABER 6-UNIT BATTERY ANALYZER (HLN1001)		300
MOT SABER CARRY CASE W/360° SWIVEL		(NEW) 20
MOT SABER REMOTE SPEAKER MIC		(NEW) 60
MOT MX SERIES REMOTE SPEAKER MIC		(NEW) 35
MOT SP10/P50/P10 1-HR CHARGER	20	25
MOT SP10/P50/P10 10-HR CHARGER	10	10

MOTOROLA

N.O.S.* **"HT1000"**

450-520 MHz
4 watt
16 Freq.
w/accessories
$575

*N.O.S. (New Old Stock)

MOTOROLA

Reconditioned **"P200"**

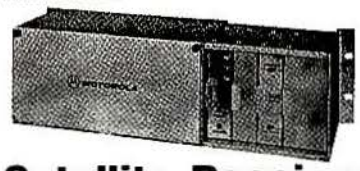
146–162MHz
2 watt
6 Freq.
w/o charger
or battery

$180

Limited Quantity

MOTOROLA

Reconditioned



Satellite Receiver
150/450MHz
P/N NO RTB1100C
$300
Voting Receiver: as above with encoder
$350
Voting comparator: CALL

IT'S NEW!

MOTOROLA "TS10"

Features identical to the Radius "SP10"

VHF: 1 watt
UHF: 2 watt
1F Radio

14 possible VHF
15 possible UHF
frequencies.

Uses all SP10 accessories.

	1–5	12+
VHF:	141	*
UHF:	161	*

w/"PL" add $32

SAVE THIS AD

CALL FOR OTHER RADIOS & ACCESSORIES!

***CALL FOR LOWEST PRICES**

WE STOCK "PL", PAGING REEDS AND CHANNEL ELEMENTS

"MAXIMIZE YOUR PROFIT"
BUY FROM

AIR COMM

TWO-WAY RADIO SALES

Phone: (602) 275-4505 • Fax: (602) 275-4555
4614 East McDowell Road • Phoenix, AZ 85008

SAVE THIS AD

Circle (112) on Fast Fact Card

equipment for sale

CLEARLY AFFORDABLE

1YEAR LIMITED WARRANTY*

Put the crisp, clean sound of Motorola quality to work for you with the clearly affordable TS10 portable radio. This tough talking two-way packs a lot of power in a compact, easy-to-use package, yet starts at just $118.00.

Get your message through loud and clear with up to 2 watts (UHF, 1W-VHF) in a palm sized package. Your range could be up to 2 miles depending on the terrain.

- Synthesized models, VHF or UHF
- Weighs just 11 ounces
- Select "dot" or "star" frequencies
- Rechargeable NiCad battery

The Motorola TS10 portable two-way radio will help you improve your bottom line by helping you stay in touch with one person or many. To learn how the TS10 can make a difference in your business, call us today.

RESELLERS ONLY
Exclusive territories available

Ⓜ and Motorola are trademarks of Motorola, Inc. FCC License Required. *See dealer for details.

PROCOMM HDQTRS
1372 Harmony Ct.
Thousand Oaks, CA 91362
Ph: 800-497-2394 • 805-494-5078
Fax: 805-494-3115
e-mail: procommusa@aol.com
www.procommusa.com

Circle (113) on Fast Fact Card

MOTOROLA & MISC.

2	GP300 UHF 2ch H/Pwr 438-474 Used: batt, ant & charger	$350
1	MT1000 42-50MHz 6ch w/scan, batt, ant & charger	$450
1	MT1000 438-470MHz 16ch w/scan, batt, ant & charger	$400
1	Saber 1 VHF Secure 5D 148-174MHz w/batt, ant	$525
1	Saber 1 VHF Secure 5D 157-174MHz w/batt, ant	$475
1	Saber 3 VHF Non-Secure 5D 146-162MHz w/batt, ant	$750
1	Saber 3 UHF Non-Secure 6D 440-470MHz w/batt, ant	$550
6	Saber 3 UHF Non-Secure 5D 440-470MHz "like new" w/batt, ant	$475
1	MTS2000 48ch flashport 403-470 Secure capable w/batt, ant & chgr	$750
6	Syntor VHF Pac-RT 158.235 PL ZA w/wiring harness	$150
10	Syntor VHF 40w transceiver only	$95
12	Syntor X/X 29-54MHz 100w transceiver only	$275
12	Syntor X/X 29-54MHz 100w complete	$500
10	Syntor X/X 150-174MHz 100w transceiver only	$150
1	Syntor X/X Dual band 100w w/palm mic controller	$650
6	Syntor X/X 9000 32ch 100w 29-50MHz complete	$950
7	Syntor X/X 9000 140-170, 64ch Secure, radio only	$300
7	Syntor X/X 9000 440-470, 32ch Secure w/board complete	$1200
5	Syntor X/X 9000E T35 800MHz Smartnet radio only	$150
7	Syntor X/X 9000E T45 800MHz Smartnet radio only	$250
13	Syntor X/X 9000E T45 800MHz Smartnet complete	$500
5	Syntor X/X 9000E 800MHz 64ch remote head "new"	$250
2	Maxtrac VHF 2ch 146-174, 45w complete	$300
2	Maxtrac VHF 2ch 42-50, 60w complete	$400
5	Maratrac 99ch Display head HCN1089A	$175
1	Spectra VHF 40w D/mount 147-174 A7 complete	$950
3	Spectra UHF 30w D/mount 438-470 A7 complete	$1200
3	STX 821 Smartnet 1.0/1.1 full keypad, batt, ant, charger	$900
7	STX Smartnet controllers 2.4/2.6	$225
9	STX Full keypad display w/PP controller	$350
16	STX P/P controllers 3.4, 5.0, 5.1	$45
10	MTX8000 Smartnet 1, 2, 2i full keypad w/batt, ant, charger	$575
8	GTX 8ch 800MHz P/P Type 2 w/keypad display batt, ant	$200
1	MSR2000 UHF 100w repeater 450-470, no duplexer	$2100
1	MSR2000 VHF 100w base ST 160MHz, no duplexer	$1900
1	MSR2000 VHF 100w repeater w/duplexer 153MHz	$3500
1	Microwave system w/dishes (2 ea), MR200 (3 ea)/MR600 (3 ea) complete	$3000
10	Master 2 Executive 45meg 100w complete	$75
18	Master 2 Executive UHF 461-466 complete	$100
1/1	VHF/UHF Master 2 repeaters, no duplexer	$1200

407-253-0889 "1 month warranty"
M-Thurs 8:30am-6:00pm EST – Ask for John
http://www.surfusa.com/PanikElectronics.HTML

Guaranteed Best Price on
Radius KENWOOD
& Fire Department Pagers
SALES & SERVICE
It's in stock; we'll ship tonight!
Radio wholesale
800-53-RADIO

BUY & SELL QUALITY USED EQUIPMENT
Motorola • Uniden • Kenwood
Johnson • VHF • UHF • 800MHz
900MHz • Mobile • Portables
Repeaters
PLANO COMMUNICATIONS INC.
1-888-906-9006

GE MASTR II Comb. EX76KKP66C, 100 watt, PLL exciters, double cases, w/o accs. ..... $100 ea.
w/accs ..... $130 ea.
GE MASTR II Comb. MX76KFP66A, w/o accs. $50
w/accs $80
GE MASTR II Comb. EX76KKS66A, w/o accs. ... $100
GOOD CONDITION BUT AS-IS, PLUS SHIPPING
David Mathews • Ph: (205) 553-3059

FOR SALE
Marconi 2955R & 2957R,
Best offer
HP8920A–all options–$8500
718-783-6000

ICOM equipment bought, sold & repaired. New low cost mobiles & portables now in. Dealers welcome. VISA/MC/AMEX.
SWS Security
(410) 879-4035
www.swssec.com or Sales@swssec.com
ICOM ICOM ICOM ICOM ICOM

STATION IDENTIFIERS
- ❑ Morse code and Voice ID
- ❑ 3 monitors and 3 timers
- ❑ Several models available
- ❑ Special prices for a limited time

RACOM 800-722-6664 216-351-1755

classified

equipment for sale

Dawn Rhoden

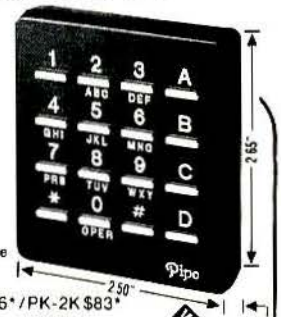
For advertising information, call 1-800-347-9375

DTMF/encoders

STEEL KEYS
SEALED GOLD CONTACTS

An ultra high quality DTMF Encoder for absolute reliability and function.

- Contacts are Water Proof/Dust Proof
- Completely Self Contained — No RFI
- Simple 3-Wire Connection • Output Level Adj
- Wide Operating Range 5 to 16vdc
- Wide Temperature Range -22°to +160°F
- Supplied with Instructions, Schematic, Template & Hardware



Call or Write for Free Catalog

PK-1 $71* / PK-1K $78* W/Relay

VISA/AMEX

*Request Quantity Price

PK-2 $76* / PK-2K $83* W/Relay

We've moved!

Mail Order To: **Pipo Communications**
Emphasis is on Quality & Reliability
1516 Cassil Place
Hollywood, CA 90028-7106
Tel: 323-466-5444
Fax: 323-466-1520

Parts of Los Angeles area code 213 is now 323.

Circle (114) on Fast Fact Card

Wireless... Remote... Control... Anything...

PageTap

Technically, we are on solid ground. You have the wireless application, we have the solutions. We now have Flex capabilities in all of our products.

THE WIRELESS CONTROL SOURCE

PageTap, Inc.
tele. 303-337-4811
fax 303-337-3084
http://www.pagetap.com

CELLULAR & PAGER LABELS

LABELS THAT STICK!

Labels for pagers, cellular phones and two-way radios with your company's logo. Warranty labels for batteries. Bar-code printing systems.
Call us for free samples.

ADVANCE LABEL & TAG
1725 N. McDonald St.
McKinney, TX 75069-8230
1-800-466-5345 FAX: 972-548-2518 972-542-5345
www.altag.com

World Class Service for Worldwide Customers!

TRIANGLE COMMUNICATIONS INC.

Used Equipment For Sale

Motorola MT500 Portables	GE MLS UHF Mobiles
Motorola P50/110 Portables	GE Phoenix Portables
Motorola M100 Mobiles	Power Supplies
Motorola MaxTrac Speakers	Power Amplifiers
Mitrek UHF Mobiles	Maxar/Maxar 80 Mobiles
Micor UHF Mobiles	GE MVP Mobiles
EF Johnson 86XX Mobiles	Misc Remote Units
Uniden FMU250 Mobiles	Misc Crystals
GE Red Bricks	DB4075 Duplexers

Call For Further Details
800-828-7716

940 West Main Street New Holland, PA 17557

GP-68 GP-88 GP-300

SPECIAL PRICES and in STOCK!
VHF 136-174 MHz
UHF 430-470 MHz
20ch or **16ch**
DTMF Keypad **(CP-50/GP-68)**

Features:
PL/DPL built-in
9 DTMF memories
Auto or Programmable Repeater Offset
2 or 5W Power level

SAME DAY SHIPPING!

All (CP-50/GP-68) radios include:
3 hour rapid charger
1200mAh battery

E-mail: info@nsiradio.com

NSI Communications
Tel: (253) 946-2426
Fax: (253) 946-8311
some items export only

WE BUY AND SELL USED MOTOROLA, GE AND ERICSSON FM TWO-WAY RADIOS

SCHAEFER RADIO CO.
130 West Fayette St.,
P.O. Box 395
Denver, IA
50622
PHONE:
(319)
984-6115
FAX:
(319)
984-6220

14 ea.	PURC 5000 Bases, 900MHz, G2934A
12 ea.	PURC 5000 Bases, 900MHz, C85JLB1101A
8 ea.	MICOR PURC Bases, 900 MHz, C75JZB1101A
5 ea.	SYNTOR XX, 800MHz, T45XAJ5G11AK
20 ea.	MTX810, 800MHz H25JBF51B1AN
20 ea.	MTX800, 800MHz H25JGB5170
1 ea.	MICOR Comm Rptr., 460MHz, D64RCB3105AY
2 ea.	MICOR Bases, 460MHz, D64RCB1105AT
73 ea.	SYNTOR X 9000, 460MHz, T34KEJ7J04AK
5 ea.	MARATRAC, 460MHz, T74XTA7TA7BK
33 ea.	MITREK, 460MHz, T44JJA6000
2 ea.	MICOR Base, 155MHz, C73RTB1145
10 ea.	MARATRAC, 155MHz, T83XTA7DA2
7 ea.	SYNTOR, 155MHz, T83SRA3200
5 ea.	MITREK, 155MHz, T83JJA3000
30 ea.	MT500, 155MHz, Mixed Models
19 ea.	SYNTOR X, 30-50MHz, T71VBJ7204AK
30 ea.	MARATRAC, 48MHz, T81XTA7DA3AK
33 ea.	MITREK, 48MHz, T81JJA4000
15 ea.	RADIUS, 47MHz, D51LRA9CA5
10 ea.	MICOR Bases, 37MHz, C71RTB1406
5 ea.	RADIUS P50, 39MHz, H41GNU1120BN
3 ea.	MICOR, 31MHz, T71RTN3400A
60 ea.	Tone and DC Remote Desk Sets, Mixed Models
29 ea.	Local Control Desk Sets, T1903
2 ea.	DICTAPHONE 4000 20 ch Recorders
39 ea.	Motorola SYSTEMS 90 Sirens
3 ea.	Desktop Centracom I's & 40 ea. Tone Remote Modules

WANTED: RADIUS, Bases, Mobiles, Portables, Repeaters • ALL RANGES & UHF Syntors

---

Want more information on advertised products? Use the Fast Fact Card!

equipment for sale

IT WORKS.

MRT'S CLASSIFIEDS GET RESULTS.

TO PLACE YOUR AD, CALL Dawn Rhoden at 913-967-1861

Compatible Motorola® Radio Programming Equipment

PA-I Programming Adaptor...$139.95
- Compatible with "RIB" unit.
- Rugged steel case.
- Power LED.

NOTE: Hardware Only. Software sold by Motorola® and other products are Trademarks of Motorola®, Inc.

PA-II Programming Adaptor...$159.95
- Contains rechargeable NI-CAD Batteries: Perfect for field use and Portable. Laptop & Notebook Computers.
- Status LEDs: Power On and Charge
- Power Switch.
- Power / Charger Included.
- Runs for 8 continuous hours from a full charge.

FULL LINE OF PROGRAMMING CABLES AVAILABLE
NEW! GP-350 Cable $149.95
RADIUS® SP50.....$99.95
Package Deal Discounts..15%
GP300/P110, HT50/P100, STX, Gemini, VISAR, JEDI, HT/MT, SABER, SPECTRA®, RADIUS® MOBILES, MAXTRAC®, and More!

PA-III Pocket Programmer...$189.95
- Micro-Size Design for Convenient Portability and Field Use.
- Uses Surface Mount Technology.
- Rechargeable ---- Works hours on one charge.

IMPORTANT
Reference code number when Ordering Catalog
Code Number: MR67

Polaris Industries

1-800-752-3571

Orders before 1pm EST are Shipped that Day!

Prices, availability and specifications are subject to change without notice. Shipping and Handling are not included with price

470 Armour Drive NE • Atlanta GA 30324-3943 • Tech Info: 404.872.0722 • FAX: 404.872.1038

Circle (115) on Fast Fact Card

HC ANTENNAS & BATTERIES
(Best Antenna & Battery Pricing in the Industry!!)

NMO Mobile Antennas

Low Band		
HC29	29.5–35MHz quarterwave	$15.99
HC34	34–40 MHz quarterwave	$15.99
HC40	40–50 MHz quarterwave	$15.99
VHF		
HCQ151	151–162MHz unity gain, chrome	$2.64
HC150	136–174MHz 3dB gain, 5/8 whip	$13.99
UHF		
HCQ430	430–470MHz unity gain, chrome	$2.64
HC450	445–475MHz 5dB gain, 5/8 over 1/2 wave	$13.99
800–900MHz		
HCQ800	806–896MHz unity gain, chrome	$2.64
HC800	800-900MHz 3dB gain, SMR/Cellular	$9.99

NMO MOUNTS

HCM	3/4" hole mount, 17' RG58A/U coax, no conn	$5.99
HCMP	Same as above, with soldered PL-259	$6.99
HCT	Trunk lip mount, 17' RG58A/U coax, PL-259	$9.99
HCTSS	Trunk lip mount, 17' RG58A/U coax, heavy duty stainless steel, PL-259	$13.90
HCMM3	Magnet mount, 17' RG58A/U coax, PL-259	$11.99
HCL	Trunk gutter bracket, 3/4" hole "L" bracket	$1.49

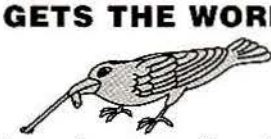
MOTOROLA BATTERIES & ELIMINATORS

HC9628	GP300 Battery	$29.00
HC8148	P110 Battery	$33.00
Batt. Elim.	GP300 Radio	$29.95
Batt. Elim.	P110 Radio	$29.95
HNN9628A	GP300 Battery (original)	$49.00
HNN8148A	P110 Battery (original)	$49.00

Quantity discounts available! No minimum order!
Same day shipping!
Order entry & customer service 24 hours/7 days
Call *today* for our FULL LINE CATALOGUE!!
Phone: 1-800-654-9550 • 973-389-9600
Fax: 973-389-9696 • E-mail: holzberg@juno.com
–Be sure to visit our website at www.holzberg.com–

Circle (117) on Fast Fact Card

THE EARLY BIRD GETS THE WORM



Call now for reservations in next month's issue of *MRT.*

Voice Pager with Monitor

Available options:
- *Vibrator add $5
- *Voice Storage add $10
- *New NiCad Batteries $6
- *Used chargers $19
- *Extended Warranty 1 year $19 - 2 Years $18 per year - 3Years $17 per year

- ☒ Durable Motorola KeyNote® pager
- ☒ Reconditioned to factory specifications
- ☒ We add our unique Monitor Adaptor - Pager functions the same as a Minitor II® in Monitor mode
- ☒ 90 Day Warranty with optional extended warranty
- ☒ Price below is on **Your Frequency** and programmed to **Your Paging Tones**

1 - 20 units $135 each 51 - 100 units $132 each
21 - 50 units $128 each over 100 units $115 each
Dealer prices only, end user prices slightly more

*Minitor II pager repair just $29.50 includes all Parts and Labor
*Minitor I & II tone reeds $25 each
*Minitor II Scan Adaptor (scan 2 channels) $55 installed, or do it yourself kit $45
*Minitor II freq conversions (board swaps)

Wanted: Pagers - Minitor II

P&W Paging and Wireless Service Center

800-822-2180

International: 561-683-0022
Fax: 561-683-0059
e-mail:pwserctr@aol.com
http://members.aol.com/pwserctr/home.htm

Circle (116) on Fast Fact Card

(540) 891-0569 We accept VISA and MasterCard Fax: (540) 891-0538

MECHEM ELECTRONICS

Massaponax Business Park
3605 Loren Whitney Drive
Fredericksburg, VA 22408
Mailing Address:
P.O. Box 7846
Fredericksburg, VA 22404

- ▶ Two-Way Radio Communications
- ▶ New and Reconditioned Radios
- ▶ Custom-Designed Radio Systems
- ▶ Repair and Programming
- ▶ Consulting

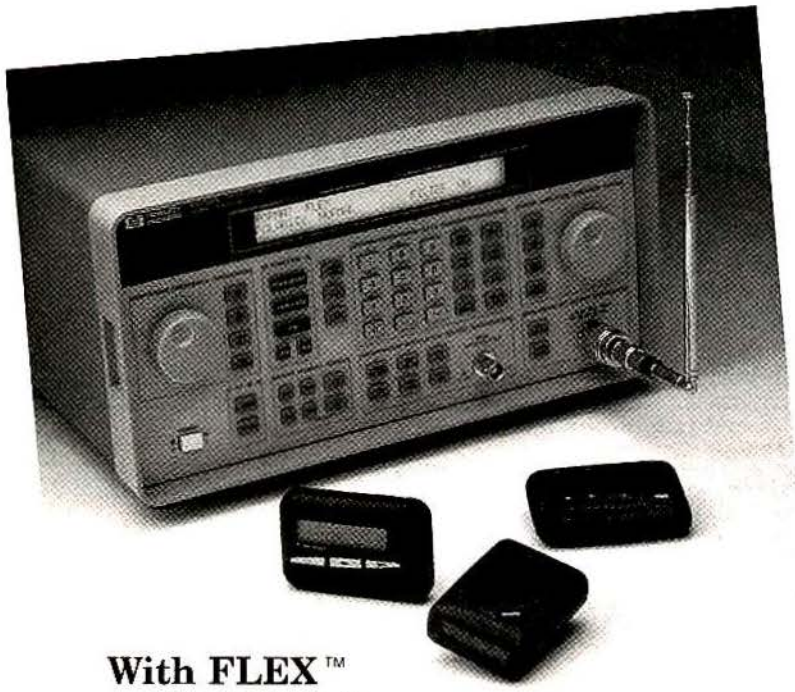
UHF 250W Repeaters (Clear and Secure)
UHF DES Repeaters 420-450 & 450-470
Dual Syntor-X Secure VHF/UHF Dual Code

VHF DES Micor Bases and Repeaters
MSF 5000 UHF Repeaters
MSR 2000 UHF Repeaters
Master II VHF & UHF Bases & Repeaters
R1032 DES Test Sets
R1033 Test Sets
R1034 Line Test Sets
RTX 4005 Portable Test Sets
RTK 4007 Auto Test Interface

URL Address: http://www.mechemelectronics.com E-Mail: mechem@fls.infi.net

Circle (118) on Fast Fact Card

equipment for sale



With FLEX™ and POCSAG

Pager Testing You Can Depend On

- Proven reliability
- Superior technical support
- Unmatched performance

For a complete solution, call your local HP field representative or 1-800-452-4844, ext. 5720

HEWLETT® PACKARD

Circle (119) on Fast Fact Card

SERVICE MONITORS FOR SALE

MOTOROLA R-2038/D/HS	$5,900	IFR 1200-S	$6,200
MOTOROLA R-2008/D/HS	5,900	IFR 1500	6,200
MOTOROLA R-2410-A	4,800	HP-8920-B	12,900
MOTOROLA R-2001/C/HS	4,200	HP-8920-A	10,900
MOTOROLA R-2600/C/HS	8,500	IFR-COM-120B	10,900

FOR SALE 19 R-2038/D/HS SERVICE MONITORS FREQ. RANGE–1 MHZ TO 1 GHZ, SPECTRUM ANALYZER/ SWEEP, DUPLEX GENERATOR, MULTIMODE CODE SYNTHESIZER, CELLULAR/TDR TEST
ASKING PRICE $5,900 EACH

USED TEST EQUIPMENT WANTED
RF IMAGING & COMMUNICATIONS
925-229-2034 FAX: 925-229-2035
http://www.best.com/~rfimage
e-mail: rfimage@best.com

COMPLETE CHANNEL ELEMENTS
YOUR FREQUENCY
LIFETIME GUARANTEE
$25.00 – $35.00

Crystals
We Buy Used Elements

NKX
1814 Hancock St.
Gretna, LA 70053
504-361-5525 (in LA) • 800-237-6519
FAX 504-361-5526

C.W. WOLFE COMMUNICATIONS
1113 Central, Billings, MT 59102

INVENTORY REDUCTION NOW IN PROGRESS.

BIG SAVINGS ON ALL OVERSTOCKED ITEMS.

Call **406-252-9220** or visit us at http://members.aol.com/cwwolfecom

CALL US FIRST
at AIR COMM
WHY PAY MORE!

Used/Reconditioned Motorola, E/GE, EFJ, Kenwood, Uniden 2-way radios **and accessories**
—ALL FREQUENCY BANDS—
PLUS
"PL" and paging reeds/filters, TCXOS
Call us last to sell any of the above.
WE PAY CASH

AIR COMM
4614 E. McDowell Rd.Ph.: 602-275-4505
Phoenix, AZ 85008 Fax: 602-275-4555

220 MHz SYSTEM

5-100 watt channels with Trident Control (dispatch only) multi-coupler combiner with separate transmit and receive antennas. 25-504 mobiles, 1 portable.

Jim Hayes (423) 546-0311

TEST EQUIPMENT - BUY & SELL!!

HP8902A Measurement Receiver-$14,900; HP8901B Modulation Analyzer-$2900; HP8901A-$1200; HP8903B Audio Analyzers-$1650; HP 8569B Spectrum Analyzer-$5900; HP4935A TIMS-$800

IFR COM 120B	$9600	IFR 1500 (mint)	$5900
IFR COM 120B/TG	$10,600	IFR 1100S	$3900
IFR COM 120A/TG	$7900	IFR 1200S	$5900
HP8920A	$9900	Wavetek 3600D TDMA	$8900
Marconi 2955A	$2900	Marconi 2957A	$3200
Marconi 2957D	$9900	Marconi 2957B	$4900
Motorola R2600C-Cell	$8500	Marconi 2955B	$4500
Motorola R2600C CBS	$15,900	Motorola R2001D	$5900
Motorola R2400A	$4800	Motorola R2200B	$3600
Synth. 1000 Mhz Sig. Generators			
HP8657A	$3200	Fluke 6060A	$1700

Amtronix
Ph: 716-763-9104, 716-661-9964 Fax: 716-763-0371
http://www.amtronix.com

classified

equipment for sale

DEALERS WANTED

Now you can be a dealer in a new line of

MOTOROLA 2-WAY RADIOS

WETEC ELECTRONICS

AUTHORIZED MOTOROLA TS-10 DISTRIBUTOR

Call Now **1-888-GO-WETEC, ext. 10** Visit our website at: www.wetec.com

Circle (120) on Fast Fact Card

EQUIPMENT FOR SALE

10 Motorola Purc 5000 VHF 350 Watt
9 Motorola Micor Purcs 375 Watt
B93J2B1101 with Advanced Control Mods
10 Mot Nucleus Purc Hipower
Simo Histab w/Batt Revert
2 ASC Controllers
10 GE MASTR II 800 Conv. 35 Watt Repeaters
22 900 MHz Purc 5000 DRC/ACB/Tone
6 Mot Micro 40-50 MHz Purc 375 watt
6 Mot 900 MHz Trunked MSF-5000 150 Watt Cont.
4 Mot T5272A 800 14 CH Controller
45 Mot Desktrac 800 T Repeaters
4 Mot Quantar 800 T

WE BUY USED RADIO EQUIPMENT
WE PAY THE HIGHEST PRICES
SCOTT COMMUNICATIONS
KEN SCOTT 406-745-3218
email: scott@montana.com

Nationwide Radio Wholesale, Inc.

HT1000 PORTABLES BELOW DEALER COST

(630) 752-0059

FOR SALE USED

30	8600 EFJ Complete	$150.00
40	8604 EFJ Complete	$150.00
15	LMX 1101BK	$100.00
15	SMS 815TS	$100.00

1-800-968-7820

computer software

Form 600 Made Painless

New Software!

* Print your FCC Form 600 on plain paper
* Prepares Form 600 for all Radio Services
* Convenient menu selection of answers
* Metric & NAD conversions included

By express $350 By mail $325

Brown and Schwaninger

Call for demo disk **202/223-6041**

Circle (121) on Fast Fact Card

rentals

MOTOROLA
RADIO RENTALS

- HT1000, GP300, P200
- Intrinsically Safe
- Full Line of Radio Accessories
- Mobiles & Repeaters
- 24-Hour Service
- Dealer Inquiries Invited

1-800-283-COMM
EVENT RENTAL COMM., INC.
e-mail: eventcomm@aol.com

MOTOROLA® 2-WAY RADIO RENTALS

• Top Quality • Low Cost
• Overnight Delivery Anywhere

MOSS COMMUNICATIONS
800-822-MOSS
www.mosscom.com

The worst mistakes are the ones you can't see.

Global Trunking Management & Billing Solutions for...

SmartNet • SmartWorks • SmartZone
LTR • MPT 1327

For more information, call (903) 561-6673 or www.GenesisWorld.com

Genesis
where great ideas begin...

Circle (122) on Fast Fact Card

computer software

RFCAD

new level 2.0

Come see us at APCO Booth #1208

- Seamless rasterized topographic maps
- International enhancements
- Import of multiple terrain data formats
- Biby-D advanced propagation model
- MapInfo file import
- CDS matrix calculation method

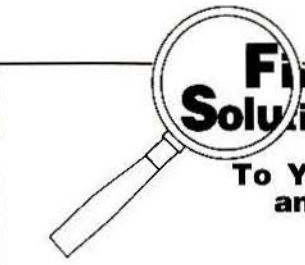
RFCAD provides high-resolution propagation results overlaid on seamless rasterized topographic maps. **RFCAD** has been designed to enable the most efficient and accurate planning, and analysis of RF sites, and systems.

32-bit application designed for Windows 95/NT™

800-441-0034
www.comm-data.com

Communications Data Services, Inc.

Circle (124) on Fast Fact Card



Find Solutions

To Your RF Coverage and Site Management Problems... On your own PC!

For either microwave links or area coverage, our Terrain Analysis Package (TAP)™ software helps you find system design solutions in-house.

See details and download demo from our web site!

SOFTWRIGHT, LLC
1010 So. Joliet St. Suite 204
Aurora, CO 80012-3150 USA
Tel. (303) 344-5486 • Fax: (303) 344-2811
www.softwright.com
e-mail: sales@softwright.com

Circle (123) on Fast Fact Card

Use COLOR to make your ad STAND OUT!

**** WIRELESS SOFTWARE ****

Save time designing, optimizing and managing wireless Radio communication sites:

- Intermodulation Interference Analysis
- Transmitter Noise Analysis
- Receiver Desense Analysis
- Signal Level Analysis
- Communications Site Design
- Site Management Database
- Equipment Maintenance and Inventory
- Desktop Mapping and Data Products

COMSITE™

CALL 800-845-0408 or 850-906-0748
http://www.polaris.net/~douglas

Service - Sales - SMR Billing
Pager Billing - Accounting

NOW AVAILABLE
CRI – PRO
YEAR 2000 COMPLIANT

DOS • NOVELL • LANTASTIC • UNIX

We can provide complete solutions including software, hardware, and training.

205-987-1523/205-987-1709 FAX

Circle (125) on Fast Fact Card

Radio Propagation Software for PC's / WINDOWS

- LMR Predicted Area Coverage - Multi-Site Composite Coverage Maps
- No Radial Generation Required - Real Time Propagation Study / Profiles
- DXF / BMP File Formats - Interface with AutoCAD, MapInfo
- Multiple Propagation Models - Longley-Rice, Okumura, Field Strength
- VHF - UHF / Microwave Point-to-Point Path Profiles and Link Analysis
- 30 Meter and 3 Second Terrain Data - Entire USA On Single CD-ROM

Micropath® Corporation
2023 Montane Drive East • Golden, Colorado 80401-8099
Tel: (303) 526-5454 • Fax: (303) 333-4386
e-mail: microinfo@micropath.com • www.micropath.com

Intertec Books
www.internettelephony.com
Your Internet Shopping Resource!
MRT™ **PRIMEDIA** *Intertec*

Software For
FCC FORMS | **FCC Licensing and Price Quotes** | FAA FORMS
Slattery Software
(941) 697-8008 www.ewol.com/slattery

repairs

Programming - Same-Day Turnaround on Most Makes and Models
We Service Most Makes & Models • Fast Turnaround • 15% Discount on Service Parts

GENERAL COMMUNICATIONS

Mobile Communications

DISTRIBUTORS OF MOBILE COMMUNICATIONS EQUIPMENT

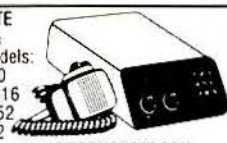
800-356-3200 • www.gencomm.com

5157 Anton Drive • Madison, WI 53719 • 608 271-4848 • FAX 608 274-2080

Circle (126) on Fast Fact Card

$25.00 FLAT RATE
Plus Parts & Shipping
On the following models:

XLH-250 RH-250
RH-256 WH-2516
WH-2510 RFH-252
UC-102 UC-202
TRH-202



REGENCY/WILSON

*OTHER MODELS—$30/HR Plus Parts & Shipping

MULTICOM
527 S. Broadway
Moore, OK 73160
405-799-7356 800-880-7356

• FAST TURNAROUND
• FACTORY TRAINED
• VISA - MASTERCARD - COD

Use COLOR to make your ad STAND OUT!

Two Way/Paging Test Instruments

Sales of New and Used

Get Your Test Equipment Needs From Service Professionals

We Take Trade-ins and Buy Used Monitors

Repair and Calibration of Communication Service Monitors

NS Electronics Service, Inc.
3610 Dekalb Technology Pkwy.
Suite 110/111
Atlanta, GA 30340
Telephone: 770-451-3264
Fax: 770-458-8785

www.nselectronics.com

MRT™

Dawn Rhoden
1-800-347-9375
Classified Advertising Manager

Loudoun Communications Inc.

Communications Systems

REPAIR DEPOT

QUALITY SERVICE ON MICROPROCESSOR-BASED MOBILES, PORTABLES AND CONTROL HEADS.
SURFACE MOUNT REPAIR. MOST REPAIRS $70 PLUS PARTS.
FREE ESTIMATES.

Warranty Service Available On:
Ericsson/G.E. • Kenwood

585 Factory Shoals Rd.
Austell, Ga. 30168 770-948-9566

Triton Electronics, Inc.

SERVICE MONITOR REPAIR & CALIBRATION
Exclusive monitor repair since 1973
NIST TRACEABLE
Cushman, IFR, Motorola, Marconi
Also, Voice Logging Recorders
4300 Lincoln Ave., Unit 0
Rolling Meadows, IL 60008
(847) 934-6426 Fax: (847) 934-7195
★ Visit our Website: http://www.tritonelec.com ★

MOTOROLA & ERICSSON

$49 Flat Rate Plus Parts

PORTABLE & MOBILE REPAIR

• Quick Turn Around • Free Return Shipping
• Factory Trained & FCC Licensed Techs

ARCOM 800•567•5636

11420 NW 45th Place • Sunrise, FL 33323

$40.00 FLAT RATE

PLUS PARTS & SHIPPING/HANDLING
PLECTRON & INSTALERT MONITORS

TWO-WAY REPAIRS ALL MAKES & MODELS
MOTOROLA MINITOR II PAGERS
$40.00/HR. PLUS PARTS & SHIPPING/HANDLING

FAST TURNAROUND, FCC LICENSED TECHNICIAN
VISA - MASTERCARD - COD

CENTURION COMMUNICATIONS, INC.
892 N. DELSEA DR. PH: (609) 794-8000
VINELAND, NJ 08360 FAX: (609) 794-8989
http://WWW.CENTURIONCOMM.COM

IT IS POSSIBLE!!!

...to receive quick, quality, service at affordable rates.

We repair:
- Transmitter Amplifiers.
- Tower top Amplifiers. (most makes & models)
- Filters, duplexers & combiners re-tuning.
- Special custom projects & equipment modifications.

ADVANCED COMMUNICATIONS & ELECTRONICS INC.
1036 Woodhaven Drive (804) 610-5473
Lynchburg, VA 24502-3757 Fax/Phone: (804) 237-4762
E-Mail: advcomm@worldnet.att.net

Regency, Relm, Maxon
Professional Two-Way Radio Repair
UHF, VHF, 800 mobiles & portables, PAs
Reasonable rates, quick turn-around

TA RADIO COMMUNICATIONS
700 S. John Rhodes Blvd. #C1, W. Melbourne, FL 32904
Ph: 407-725-4824 Fax: 407-984-9484

MRT™

Classified advertising is a smart, *inexpensive* way to reach your target audience!

Call (913) 967-1861 • Fax to: (913) 967-1735

classified

prof. consulting services

Engineering For The Wireless World

Wireless Communications Systems and Facilities

Define Acquire Build Manage
Design Zone Test Operate

RCC Consultants, Inc.

100 Woodbridge Center Drive, Suite 201
Woodbridge, NJ 07095
800-247-4796
email - info@rcc.com
Offices Nationwide & International

Circle (127) on Fast Fact Card

accessories

NEW

MINI HANDS-FREE SYSTEM

This unique combination earphone/microphone is perfect for any handsfree user. It allows for quick head movements without falling off the user's ear. The mini "boom" microphone is positioned close to the user's mouth to transmit the clearest sound with minimum outside noise interference.

Part No. HP-405

New throat activated microphones pick up only your voice and cancels out external noises. Also available for 2 way radios and cellular phones.

Part No. HP40

Motorola Leather Cases available for as low as **$2.50**

Fits Motorola, Startac and Elite phones. 2.5 mm miniplugs

ACCELE ELECTRONICS, INC. (562) 809-5090 FAX (562) 809-1248

tower space

HIGHPOINT TOWER TECHNOLOGY INC

We've made your highest expectations our goal for over 30 years!

HIGH POINT TOWER TECHNOLOGY INC.

CHALLENGE US

WE'LL PUT YOU ON SITE, ON TIME!

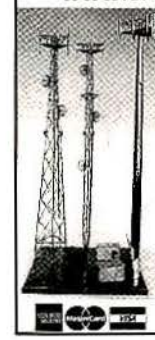
- Turn-Key Solutions
- Specialized Assignments
- Owners/Operators

If you need Florida or Metro New York, You're in our backyard!

Phone (813) 854-1518 Fax (813) 855-1969
World Wide Web: http://highpoint-inc.com E-Mail HIGHPOINT@IBM.NET

Circle (128) on Fast Fact Card

MINIATURE TOWER MODELS
www.creativesculptures.com



Pewter Castings, Specialty Awards & Gifts for the Wireless Communications Industry.

Creative Sculptures
6205 E. Tecumseh St.,
Tulsa, OK 74115
Ph: 918-832-9930
Fax: 918-834-9159
Toll-Free: 888-229-5325
e-mail: marksmith@creativesculptures.com

RESCO TOWER COMPANY

Sites available GA and SC

We build to suit.

Call Miles McSweeney
912-233-9354

ARIZONA'S PREMIER TOWER FACILITIES
Contact Rick or Charlie Bonifasi
ANTENNA SITES, INC.
800-346-7224

METRO PHILLY & METRO NYC

Nassau Tower Holdings has tower space available in NJ Sussex, Warren, Monmouth, Ocean and Mercer Counties. Downtown Princeton NOW AVAILABLE!

Call Tony Gervasi at 609-924-1515, ext. 213

NEED TENANTS??
Advertise your sites in the
NATIONAL COMMUNICATIONS SITE DIRECTORY
Dedicated to advertising antenna sites for lease
NEED SITES?
The NCSD contains thousands of prime antenna sites, all with space for lease. *Just $25 per year.* For information call: Tel: (732) 462-5964 Fax: (732) 308-1033

TEL: (847) 823-7713
CHICAGO TOWER LEASING CORP.
COMMUNICATIONS TOWER & ANTENNA SITES FOR THE METROPOLITAN CHICAGO AREA
STAN STANN
P. O. Box 31160
CHICAGO, IL 60631

tower services

Do You *comply?*

All sites must be in compliance with the new Federal RF Exposure Guidelines

ARGENT CONSULTING SERVICES, INC.

Clearly the best choice for all your environmental needs.

You need the recognized leader in radio frequency and electromagnetic exposure evaluations

Providing complete training and regulatory assistance in the area of environmental and safety compliance

Argent Consulting Services, Inc.

Please note our new address:
11999 Katy Freeway, Suite 590
Houston, Texas 77079
1-800-634-3947 • Fax 1-800-311-1278
See our website for the latest RF updates
www.argentinc.com

ad index

Company	Page Number	Fast Fact Number	Advertiser Hotline
Advanced Receiver Research	69	60	860-485-0310
AdvanceTec Industries Inc.	7	17	305-651-3211
AF Comm Supply	57	49	800-255-6222
Air Comm	87	112	602-275-4505
Andrew Corp.	18	9	708-349-3300
Anritsu Company	9	18	408-778-2000
Antenex	83	105	800-323-3757
Astron Corp	13	6	714-458-7277
Avtec, Inc.	79	59	803-892-2181
Barnett Electronics Inc.	83	104	800-423-3858
BatteryPRO Systems, Inc.	44	46	800-661-9401
BEE Electronics Inc.	36	27	800-336-3115
Berkeley Varitronics	32	15	908-548-3737
Brown and Schwaninger	92	121	202-223-8837
Cablewave Systems	25	22	203-630-3311
Canadian Marconi	57	50	613-592-6500
CELWAVE	19	10	800-321-4700
CommScope, Inc	30	13	704-323-4819
Communications Specialists	BC	3	800-854-0547
Communications Data Services	93	124	800-441-0034
Computer Resources Inc.	93	125	205-987-1523
Connect Systems Inc.	47	30	800-545-1349
Control Signal Corp.	38	42	800-521-2203
Corporation Ten International	77	33	410-821-0008
CPI Communications Inc.	75	74	972-437-5320
CTI Products Inc.	72	65	513-595-5900
Dapa Communications, Inc.	5	16	716-373-7228
Dataradio Corp.	71	63	770-392-0002
David Clark Co., Inc.	46	29	508-751-5800
Doppler Systems, Inc.	58	51	602-488-9755
EAGLE	52	35	520-204-2597
EDX Engineering, Inc.	62	37	541-345-0019
El Paso Communication Systems	84	107	915-533-5119
Gamber Johnson	70	61	715-344-3482
General Communications	94	126	800-356-3200
The Genesis Group	92	122	903-561-6673
Hark Systems, Inc.	20	11	803-875-4480
Harris	45	28	800-4HARRIS
Henry Radio	64	40	800-877-7979
Hewlett-Packard Co.	91	119	707-577-2265
Highpoint Tower Technology	95	128	813-854-1518
Holzberg Communications, Inc.	90	117	973-389-9600
Huber Suhner AG	41	44	+41 (0)71 353 41 11
Hustler Inc.	33	25	800-949-9490
Hutton Communications	17	8	800-442-3811
Icom America	35	26	206-450-6041
IDA Corporation	60	53	701-280-1122
Instrument Associates	68	55	901-947-4000
J.E.I.	74	72	916-677-3210
Kenwood Communications	27	23	800-950-5005
Klein Electronics	85	109	760-631-2811
Larsen Electronics	64	39	800-426-1656
M/A-Com Microelectronics Div.	76	57	978-442-4288
McManus Communications	82	101	870-763-6250
Mechem Electronics	90	118	540-891-0569
Micropath Corp.	93		303-526-5454
Motorola Test Equipment	21	21	800-505-TEST
NARDA/L3 Communications	29	12	516-231-1700
New Hampshire Communications	82	103	603-668-3004
Northpoint Comms Products	74	71	919-403-8598
Omnicrom Electronics	49	32	860-928-0377
Optoelectronics Inc.	IFC	1	800-327-5912
Orbacom Systems Inc.	37	41	609-829-4455
Otto	61	36	708-428-7171
PageCorp Industries	81	100	800-957-8700
Paging & Wireless Service Center	90	116	561-683-0022
Pipo Communications	89	114	323-466-5444
Polaris Industries	90	115	404-872-0722
Premier Communications	49	64	909-869-5711
Procomm	88	113	805-497-2397
Radio Express, Inc.	84	106	800-545-7748
Radiomate	77	75	800-346-6442
Raine, Inc.	75	73	765-622-7687
RCC Consultants	95	127	732-404-2400
RCW Distributing	84	108	800-726-9015
Ritron, Inc.	28	24	800-USA-1USA
Selectone	51	34	510-781-5432
Setcom Corp.	63	38	800-966-1034
Sharp Communication	82	102	800-548-2484
Shinwa Communications of America	72	66	800-627-4722
Shure Brothers Inc.	31	14	800-25-SHURE
Simulcast Solutions	76	56	716-223-4927
Sinclair Technologies Inc.	16	7	800-263-3275
Smart Link	65	54	919-303-2530
Smartrunk	39	43	510-887-1950
SoftWright	93	123	303-344-5486
Sutter Buttes Two Way	86	111	530-674-7532
TelecomLatina '98	78		303-220-0600
Telepath	73	69	510-656-5600
Telewave Inc.	43	45	650-968-4400
TESSCO	11	19	410-229-1000
Thunder Eagle	73	67	703-242-0122
Transcrypt International Ltd.	1	4	800-894-2609
Trylon Manufacturing Co Ltd	73	68	519-669-5421
Twitco Distributing	75	70	800-899-8948
TX RX Systems Inc.	3	5	716-549-4700
Vega, A Mark IV Company	12	20	626-442-0782
VERTEX/YAESU USA	IBC	2	310-404-2700
Vocom Products Co. LLC	58	52	800-USA-MADE
WETEC Electronics	92	120	901-286-6275
Xcel Controls Inc.	86	110	219-259-7804
Zetron Inc.	55	48	425-820-6363

Vertex--For Business, Industry, and Public Safety.

Vertex Radio Communications, the land mobile division of Yaesu, has been at the forefront of high-tech engineering and quality manufacturing for over 40 years. Always keeping customer satisfaction as their goal, the Vertex line meets the ever-growing demands of private sector, public safety, and governmental organizations.

The Vertex full line of wireless radio equipment is compatible with commercial specifications worldwide, and includes a wide variety of portable, compact/mobile base stations, HF/SSB transceivers, repeaters, and trunking systems.

Incorporating constant customer feedback with break-through design in synthesized radio communication technology has resulted in innovative products like the FTH-2070 32 Channel 5W Dual Band VHF/UHF Portable radio introduced in 1988. This unequaled radio gained immediate acceptance for its ability to link public safety organizations in time of crisis, and remains unique to Vertex today.

Now, with its expanded line--including the ultra-compact VX-10, 40 and 102 Channel VHF/UHF Portables -- Vertex Radio Communications provides solutions to communication needs for business, industry, and public safety.

For more information about the complete line of Vertex Radio Communications products, see your authorized Vertex dealer, or call:

562-404-2700

vertex
RADIO COMMUNICATIONS
Land Mobile Division of Yaesu U.S.A.

United States & Canada: Yaesu U.S.A., (562)404-2700. **Mexico, Central & So. America,** (305)593-2500

©1998 Yaesu USA. Specifications subject to change without notice.

Circle (2) on Fast Fact Card

NEW!

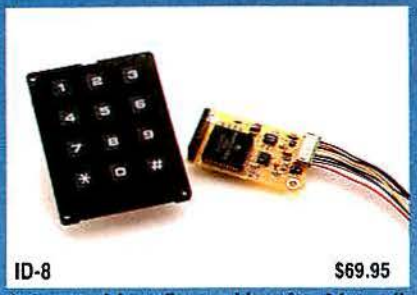
TP-3200 $279.95

Full Featured Shared Repeater Tone Panel with ALL 157 CTCSS/DCS codes. In Desktop or Rack Mount version.

NEW!

CSI-100 $749.95

Video Modem. Sends and receives broadcast quality, single frame, color video over ANY narrow-band communications channel.



ID-8 $69.95

Automatic Morse Station Identifier. Meets all FCC ID Requirements. Fully field programmable with included keypad. 1.85" x 1.12" x .35"

TE-64 $79.95

Self-contained Encoder, Rotary Dial Selection. Great for the Benchtop. 5.25" x 3.3" x 1.7"

CC-1/CR-1 $49.95 each

Surface Mount Component Kits for repairing SMT circuits. CC-1 for capacitors/CR-1 for resistors.

PE-1000 $224.95

Desktop Paging Encoder. Two-tone sequential, other formats available. 7.5" x 7.8" x 2.7"

PE-2P $54.95

Two-tone Sequential Encoder. Sub-assembly mounts inside radio or other enclosure. Multiple call capability. 1.25" x 2.0" x .4"

SD-1000 $59.95

Two-tone Sequential Decoder. Programmable unit provides switched outputs from two-tone paging calls. 1.25" x 2.0" x .4"

DTD-1 $49.95

Single Function DTMF Decoder. Provides switch outputs via DTMF. 1.25" x 2.0" x .4"

PE-4/PE-15 $79.95

Multiple Call POCSAG (RPC-1) Paging Encoders. Where direct control of local area paging is desired. 1.78" x 1.03" x .35"

DCS-23 $59.95

Digital Coded Squelch Encoder-Decoder. Programmable to all codes. 1.36" x 1.18" x .25"

TS-32P $57.95

Programmable CTCSS Encoder-Decoder. Tone squelch for any FM transceiver. 1.25" x 2.0" x .4"

TS-64 $54.95

Sub-miniature Programmable CTCSS Encoder-Decoder. 1.7" x .78" x .25"

SS-32SMP $27.95

Sub-miniature CTCSS Encoder. Jumper programmable. .53" x 1.0" x .16"

SS-32PA $28.95

Programmable CTCSS Encoder. Custom tones or audible tones also available. .9" x 1.3" x .4"

The Sky's The Limit!

For over 25 years... bringing you tone signalling products that are as reliable as the day is long. Combine this with same-day shipping, toll-free technical support, and our no hassle one year warranty, and you'll realize the sky's the limit in our efforts toward customer satisfaction.

Shown are a few of our most popular tone signalling products. Call for details on these and all your tone signalling needs. A free catalog will be mailed upon request.

COMMUNICATIONS SPECIALISTS, INC.
426 WEST TAFT AVENUE • ORANGE, CA 92665-4296
(714) 998-3021 • FAX (714) 974-3420
Entire U.S.A. (800) 854-0547 • FAX (800) 850-0547

VISA MasterCard

Outside USA or Canada: Jescom International, 1 Waters Park Dr. #117, San Mateo, CA 94403 USA · Phone (415) 574-1421 · FAX (415) 574-5297 · Also in Italy and Spain

Circle (3) on Fast Fact Card